United States Department of Agriculture

SCIENCE FORUM

Adapting the Wildlife Standard of the Eastside Screens (21" standard)

Please dial in at:
1-877-369-5243 or 1-617-668-3633,
Access Code: **0994229##**

Forest Service

Welcome to the Science Forum

Deb Whitall
Assistant Director,
Resource Planning and
Monitoring Staff

Recording the Forum

Recording Session

Phone Line is
1-877-369-5243 or 1-617-668-3633,
Access Code: **0994229##**

Connecting to Adobe

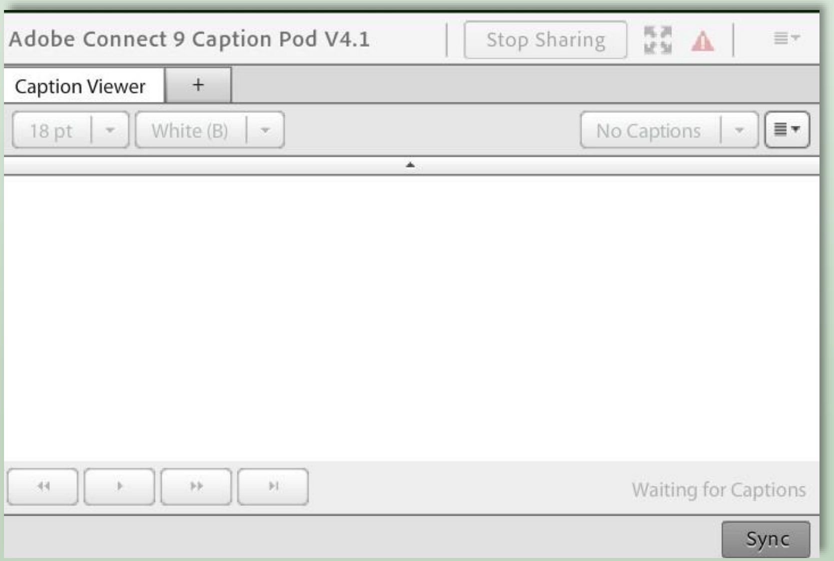
Adobe® Connect™

If Adobe Connect is taking a long time to load, you might want to try shutting down and reconnecting to Adobe Connect.

Adobe Meeting Room

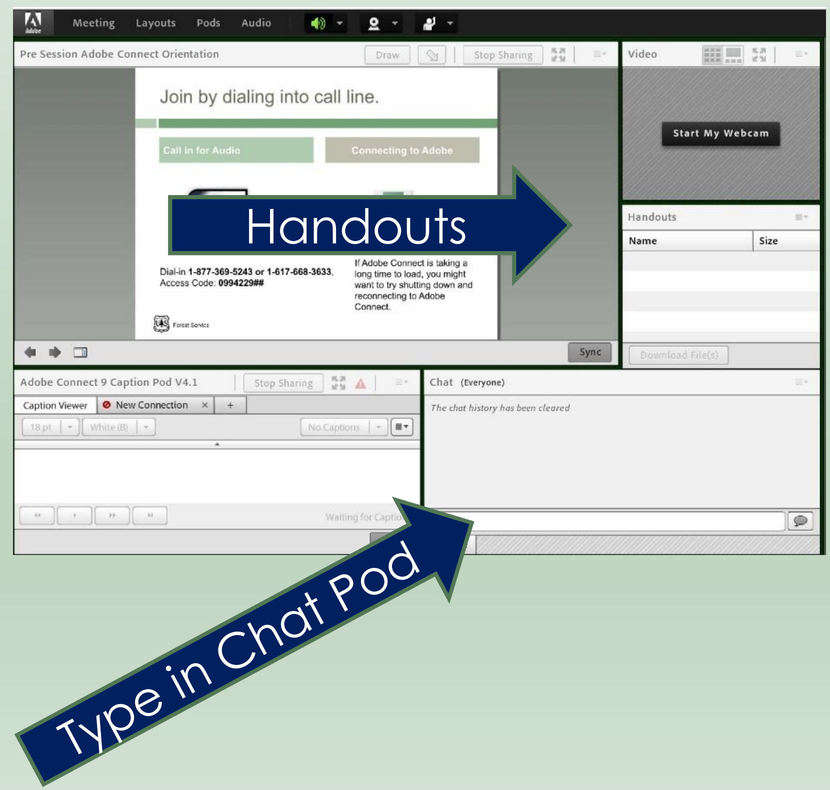
Captioning Pod

(Far-left side of the screen)



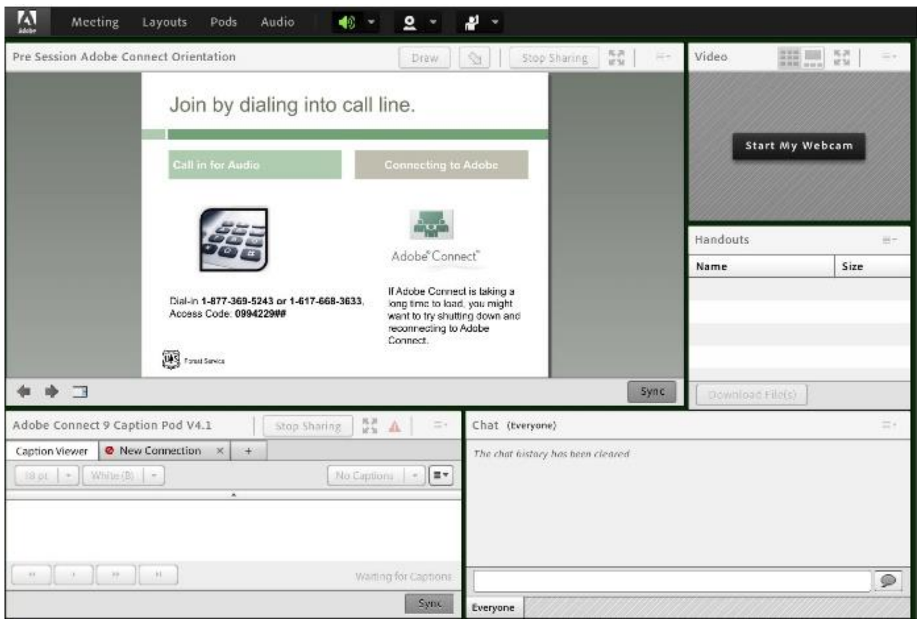
Chat Pod & Handouts

(Far-right side of screen)



Introduce Yourself in Chat Pod

Type in First & Last Name & City your are located



Forest Service

Poll 1

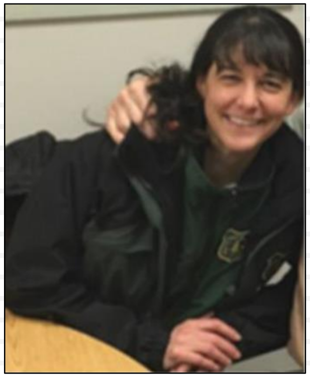
Multiple Choice Poll

What national forest are you affiliated with or which national forest do you interact the most with?

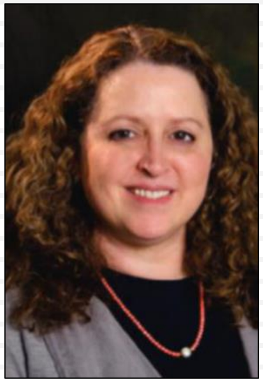
Welcome Gina Owens

Gina Owens
Deputy Regional Forester,
Pacific Northwest Region.

Interdisciplinary Team



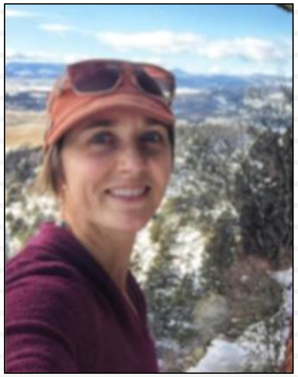
Emily Platt,
Team Lead



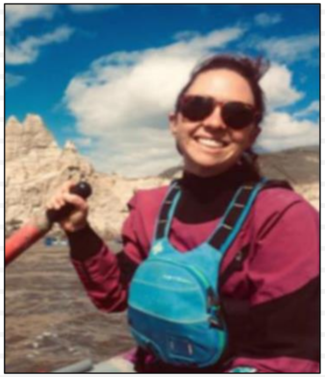
Maia Enzer,
Communications and
Engagement Lead

Andrea Dolbear,
Planning Specialist

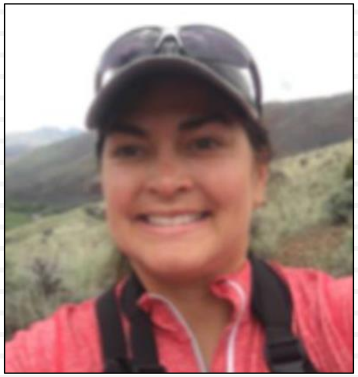
Audrey Maclennan,
Project Assistant



Carrie Spradlin,
Silviculturist



Summer Kemp-Jennings,
Ecologist



Barbara Garcia,
Wildlife Ecologist

Jordan Larson,
Economist

James Dickinson,
Landscape
Ecologist

GUIDELINES: Adapting to our Circumstances

We'll share notes and resources captured during the meeting

SHARE THE AIR

- Keep yourself muted
- when not speaking
- When called on by the facilitator,
- unmute yourself by pressing *6
- Be mindful of your own airtime as not all comments and questions can be addressed during the Forum and we'll seek to include as many voices as possible.

OFFER WHAT YOU CAN, ASK FOR WHAT YOU NEED

- Chat, connect and share

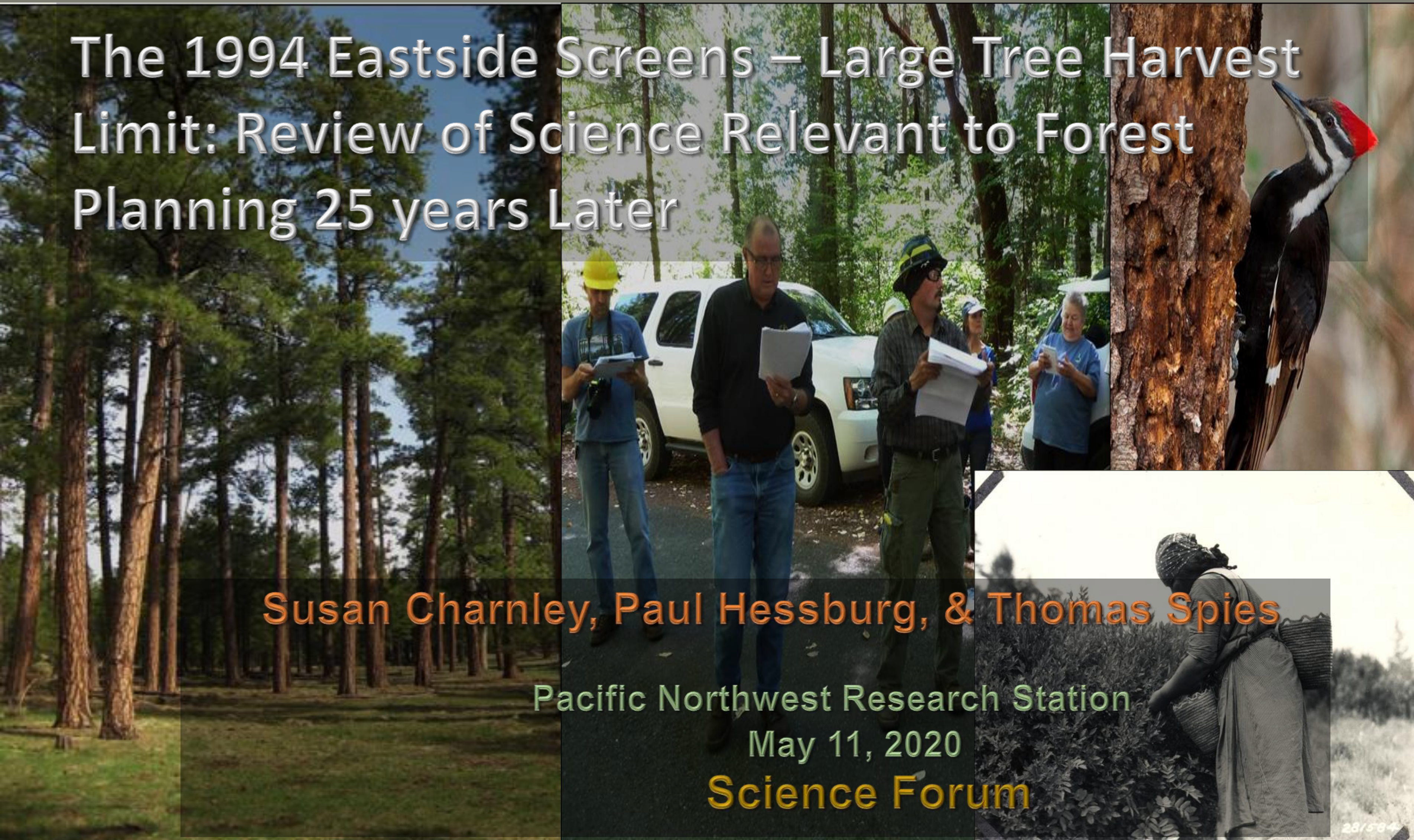
Welcome Panel 1

Susan Charnley
Research Social Scientist,
PNW Research Station.

Paul Hessburg
Research Scientist,
PNW Research Station

Tom Spies
Emeritus Research Scientist,
Pacific Northwest Region.

USDA
United States Department of Agriculture



The 1994 Eastside Screens – Large Tree Harvest Limit: Review of Science Relevant to Forest Planning 25 years Later

Susan Charnley, Paul Hessburg, & Thomas Spies

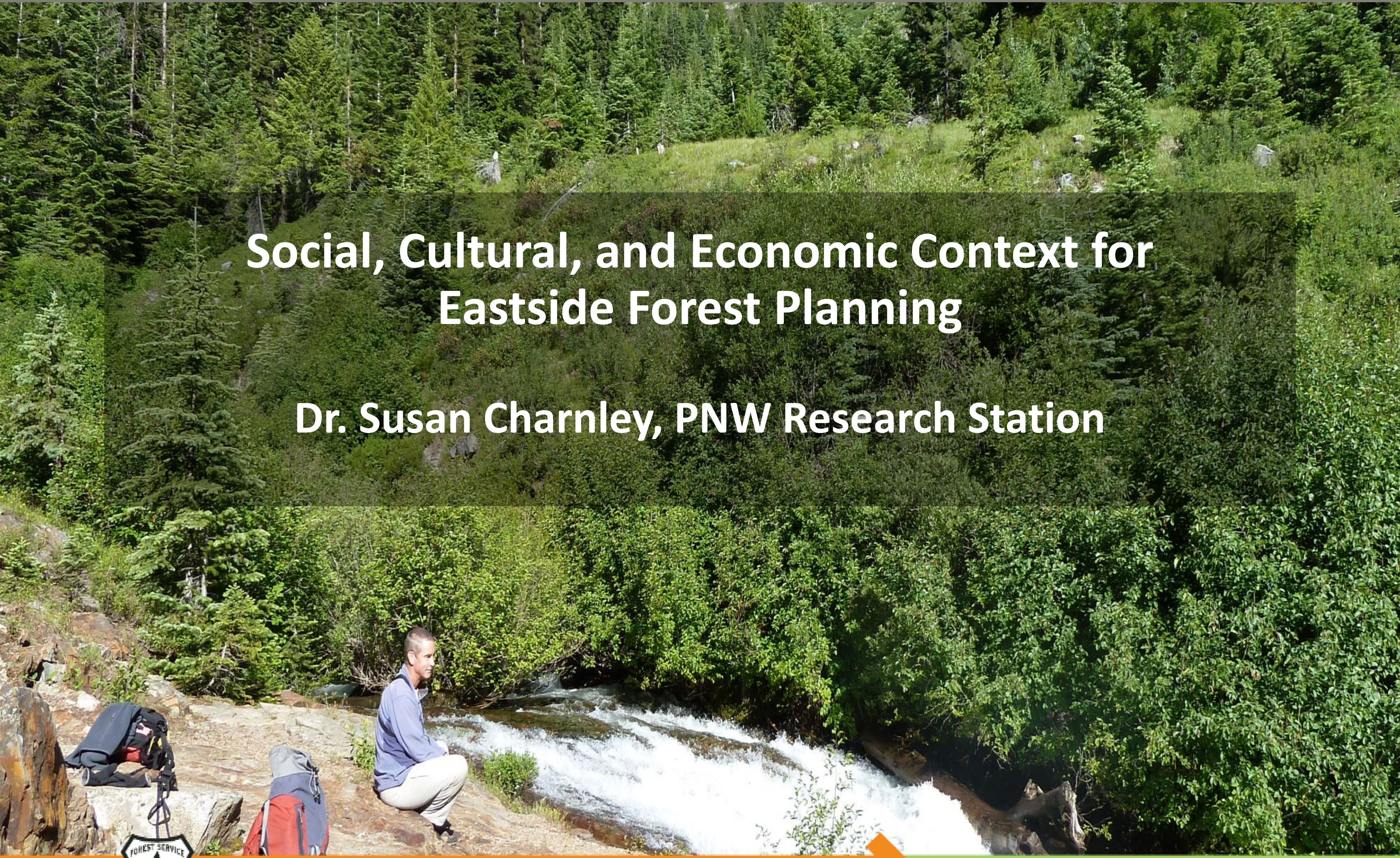
Pacific Northwest Research Station

May 11, 2020

Science Forum

Forest Service

USDA United States Department of Agriculture



Social, Cultural, and Economic Context for Eastside Forest Planning

Dr. Susan Charnley, PNW Research Station

Forest Service

Social Values and Large, Old Trees

- People value large, old trees in many ways
  - economic
  - spiritual
  - aesthetic & intrinsic
  - biodiversity & ecological
  - ancient, enduring, link between generations
  - rare, endangered, irreplaceable

Frank Lake

- Most PNW residents favor old-growth protection

Social Values and Federal Forest Management

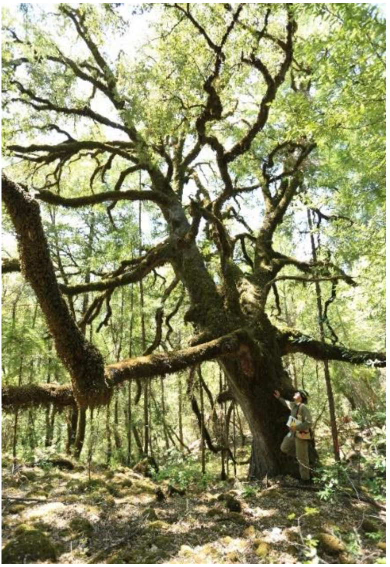
- Important social values of eastside forests
  - economic uses
  - recreational uses
  - scenic quality

- Views may vary between and within groups

- Many PNW residents support the need for restoration treatments to reduce wildfire risk

Eric White

American Indian Tribes and Large, Old Trees



Michael Hentz

- Tribes value large old trees for
  - First foods, material culture, medicines
  - Spiritual & cultural practices and beliefs
  - Ties to the past (culturally-modified & legacy trees)
  - Ecological role & importance

- Age- rather than size-based thresholds for protecting large trees may better conserve tribal values
  - Concern over fast-growing conifers displacing valued hardwood spp.
  - Concern that young, fast-growing trees act as ladder fuels & compete for soil moisture and nutrients

Luna Latimer

The Forest Products Industry

- Federal timber is important for supporting local mills on the eastside

- Local mill infrastructure helps make fuels reduction financially feasible
  - Harvesting trees >21” in fuels projects could facilitate treating more acres when stewardship contracting is used, but stewardship contracting may be controversial

- Some eastside mills have invested in infrastructure to process smaller logs
  - Given that improved local socioeconomic well-being is a key interest of collaborative stakeholders, care is needed to ensure any large trees can be processed locally

Trust

- **Public trust is critical when proposing a new policy change**

- **It takes time to build trust**

Forest PAO

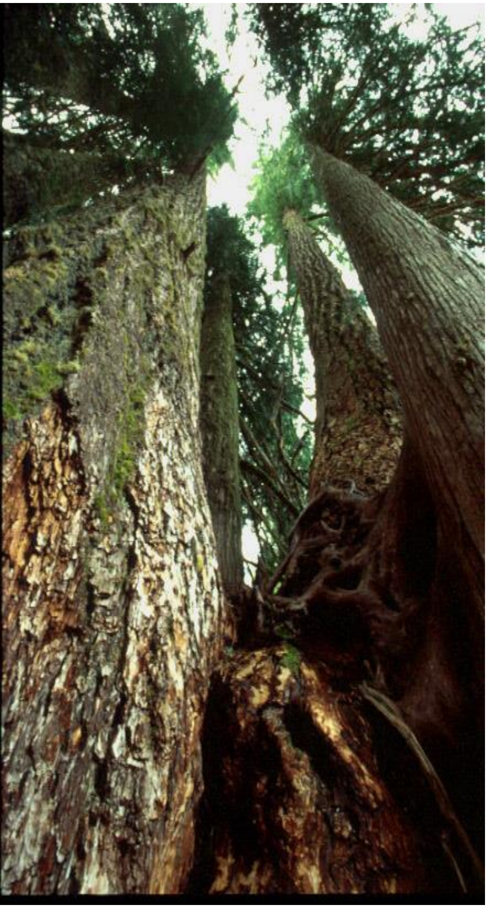
Tom Spies

Collaboration

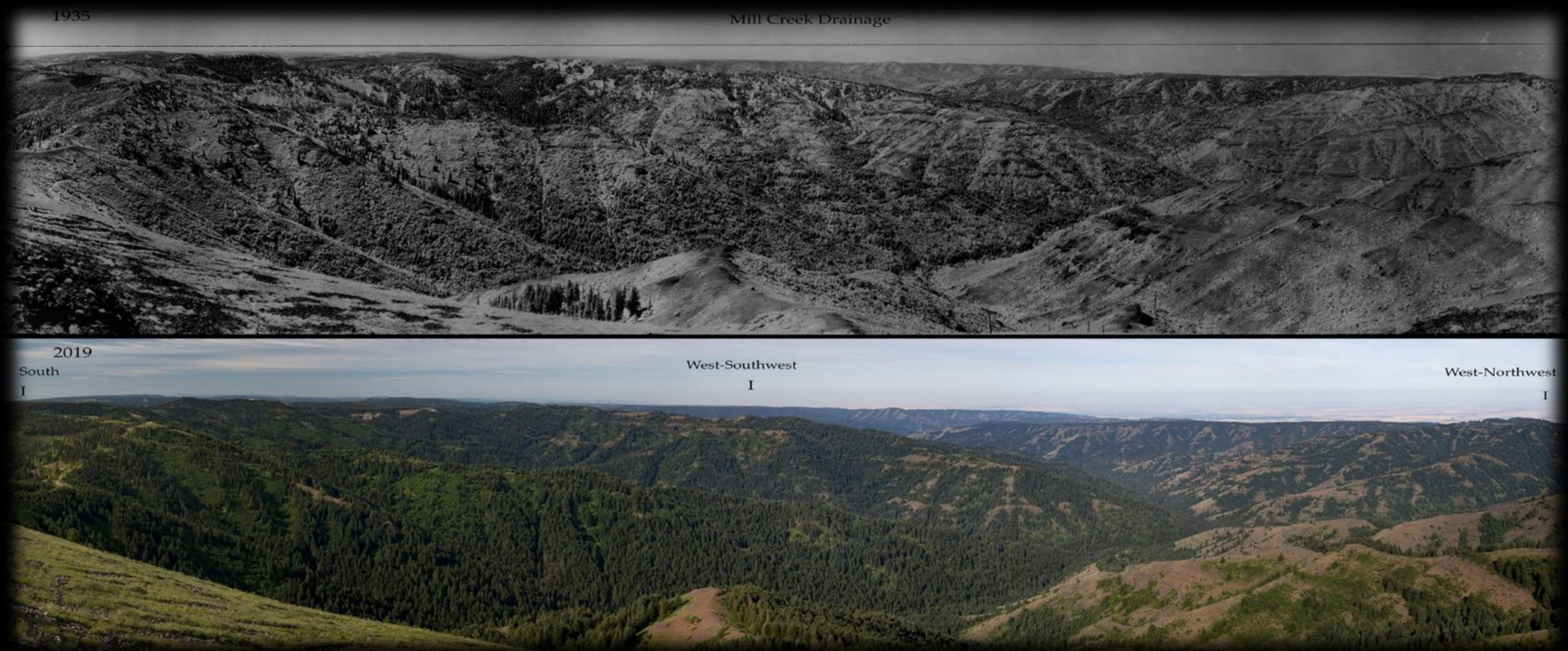
- Forest collaborative groups can help identify shared values and vision for forest management, & build trust
- If policy change is imposed from above instead of agreed upon locally, social acceptability will decrease
- Common priorities of forest collaboratives:
  - improve ecological conditions
  - build trust
  - implement projects
- There is some limited agreement around harvesting large trees, depending on species

Mark Jacques

Key Messages



- Managing for resilient forest landscapes depends on understanding changing
  - social and cultural values
  - economic conditions
- Collaborative decision-making processes to build trust & agreement around policy change are critical
- If harvesting large/old trees is perceived as being driven by commercial interests/meeting timber targets instead of ecological goals, conflict is likely
- One size fits all policies may not be appropriate



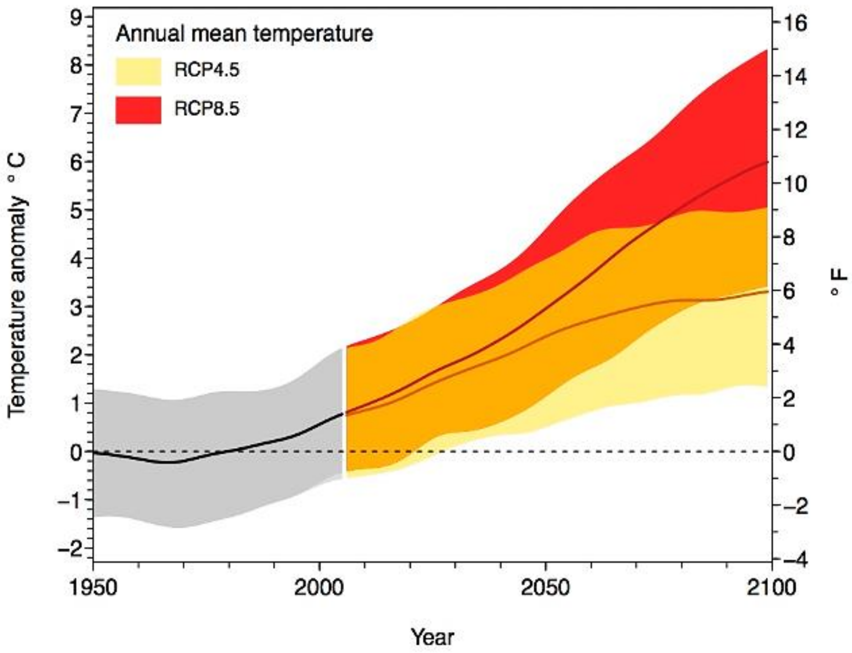
Climate, Disturbance, and the Role of Large Trees

Dr. Paul Hessburg, PNW Research Station

RECENT CLIMATE SCIENCE:
Future vulnerabilities and resilience of forest landscapes

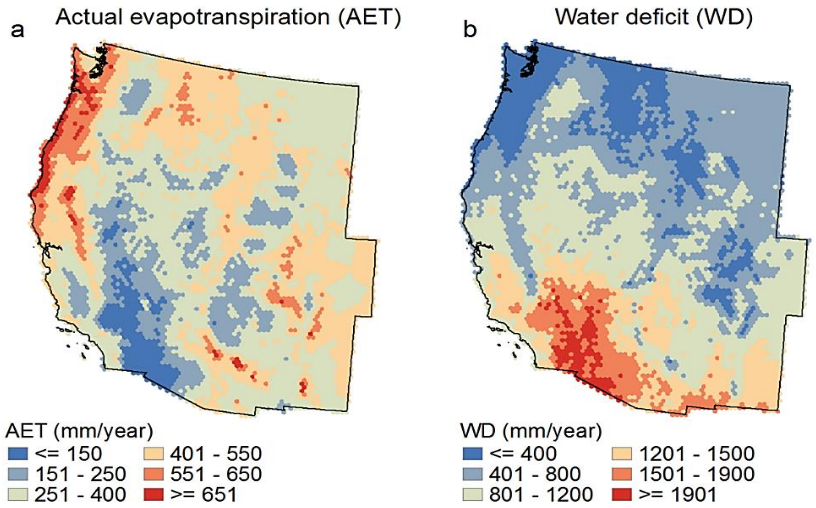
CLIMATE CHANGE IN THE PNW:

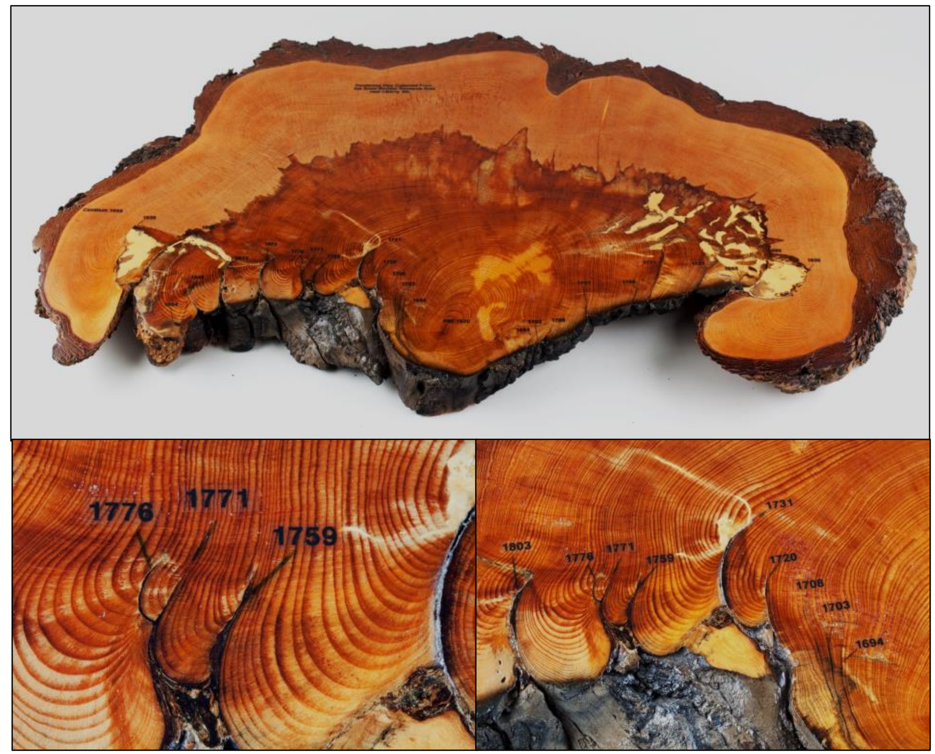
- Western US climate projections show:
  - ✓ **year-round warming**
    - ✓ *esp. summer and winter*
  - ✓ **reduction or small bump in summer precipitation**
    - ✓ *doesn't keep pace w/ warming*



CLIMATE CHANGE & WILDFIRE:

- A warming climate generally affects:
  - ✓ total # of fires, # of large fires
  - ✓ fire season length,
  - ✓ burned area,
  - ✓ burn severity
- Fire history & modern records agree



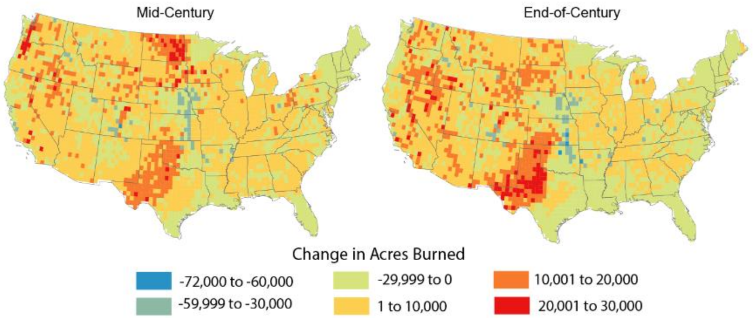


MODELING CLIMATE CHANGE & WILDFIRE

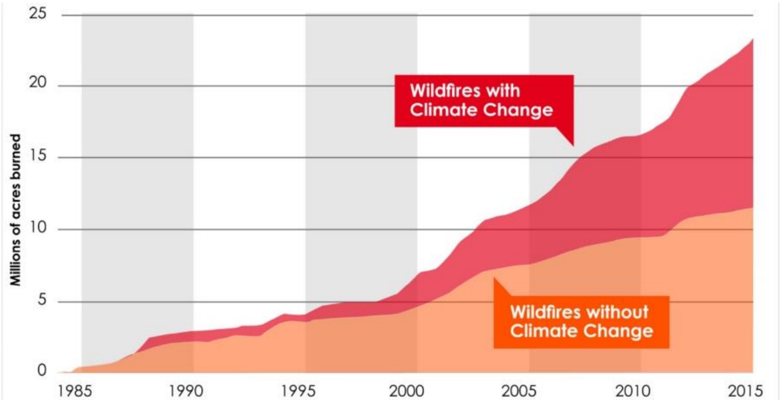
- Models show:
  - ✓ 3-4X increase in burned area by 2050
  - ✓ increasing fire sizes
  - ✓ increasing severity
  - ✓ BluMtns large wildfire area increases from 17% (2020) to 63-72% (2100), 3.7-4.2X
  - ✓ E Casc large wildfire area increases from 11% (2020) to 40–45% (2100), 3.6-4.1X

Figure 1. Projected Impact of Unmitigated Climate Change on Wildfire Activity

Change in average annual acres burned under the Reference scenario by mid-century (2035-2064) and end of century (2085-2114) compared to the historic baseline (2000-2009) using the IGSM-CAM climate model. Acres burned include all vegetation types and are calculated at a cell resolution of 0.5° x 0.5°.



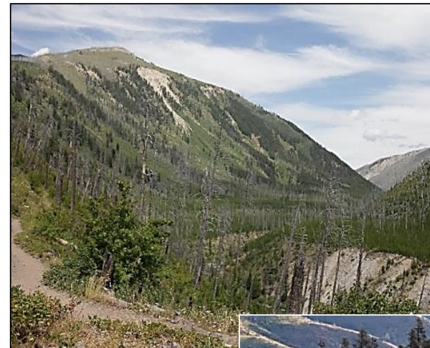
For more information, visit EPA's "Climate Change in the United States: Benefits of Global Action" at www.epa.gov/cira.

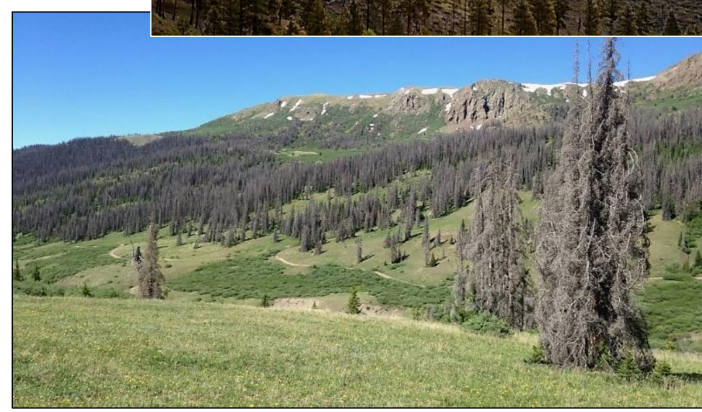


Source: Abatzoglou/Williams 2016, PNAS 113

CHANGING DISTURBANCE REGIMES UNDER CLIMATE CHANGE:

- Fire will increasingly interact w/
  - ✓ drought
  - ✓ insect & disease outbreaks
- Some forest transitions to nonforest
- Some moist mixed conifer (MMC) forest patches transition to dry mixed conifer (DMC)
- Decreased tree density in DMC and MMC
- Decreased overall forest age & old growth connectivity





CLIMATE CHANGE AND THE WILDFIRE DEFICIT

- Fire exclusion reduced burned area, e.g., see Leenhouts 1998, Cons Ecol
- **Lead to a widespread wildfire deficit, nearly all forest types**
- As the climate warms, area burned will sharply increase
- **Level off prior to mid-century due to area burned and reburned.**
- Resulting forest conditions not like historical

FUTURE CONSIDERATIONS – FUEL TREATMENTS

- Fuel treatments can be useful to decreasing fire severity locally & regionally, including:
  - ✓ Managed wildfire, this is not "let it burn", or most burn out operations
  - ✓ Rx burning
  - ✓ Forest thinning + Rx burning
- In dry and moist mixed conifer forests, esp. drier sites,
  - ✓ reducing smaller tree density,
  - ✓ competing fire-intolerant trees, & layering can help



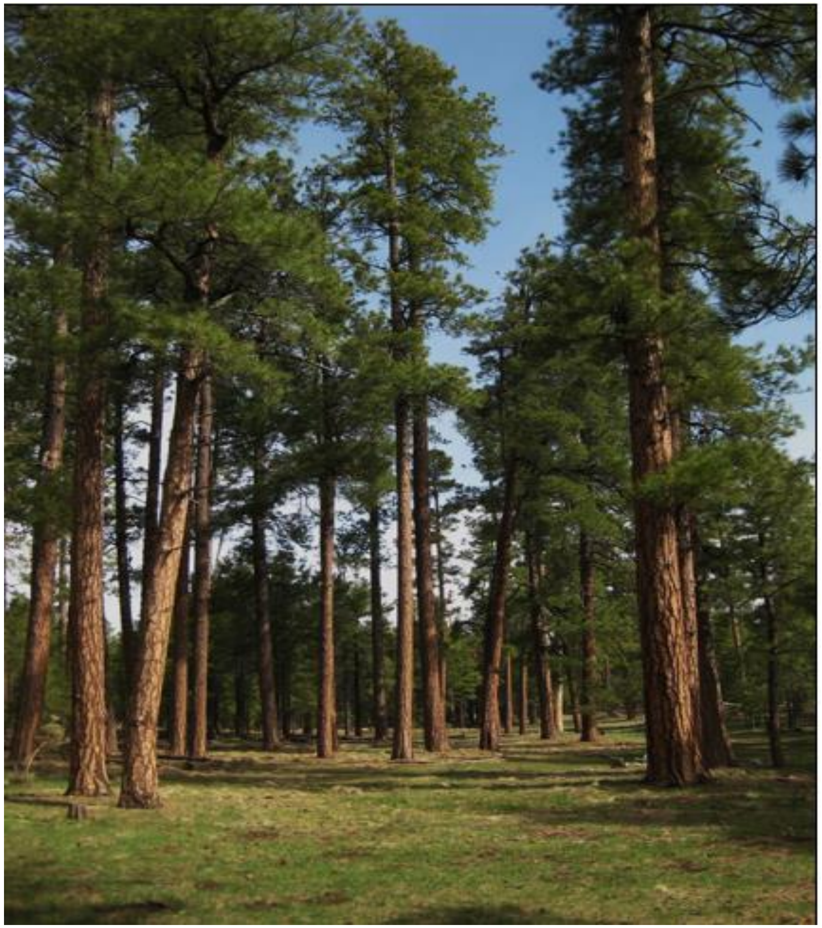
SILVICULTURE RESEARCH:
Stand development & the role of large trees

RESISTANCE, RESILIENCE, AND LANDSCAPE HETEROGENEITY:

- Silvicultural methods can aid in:
  - ✓ reducing stand density
  - ✓ increasing fire-tolerant tree species
  - ✓ protecting large trees, increasing their abundance
  - ✓ increasing heterogeneity
  - ✓ improving resistance, resilience, heterogeneity

LARGE VERSUS OLD TREES

- Old trees, even smaller ones, have high value
  - ✓ they develop unique pathological traits
  - ✓ provide WL habitat features
- Add to forest genetic diversity.
- Provide information re/ historical conditions
- Develop functional large bole, butt, branch defects
  - ✓ provide WL habitat features



LARGE VERSUS OLD TREES (cont'd):

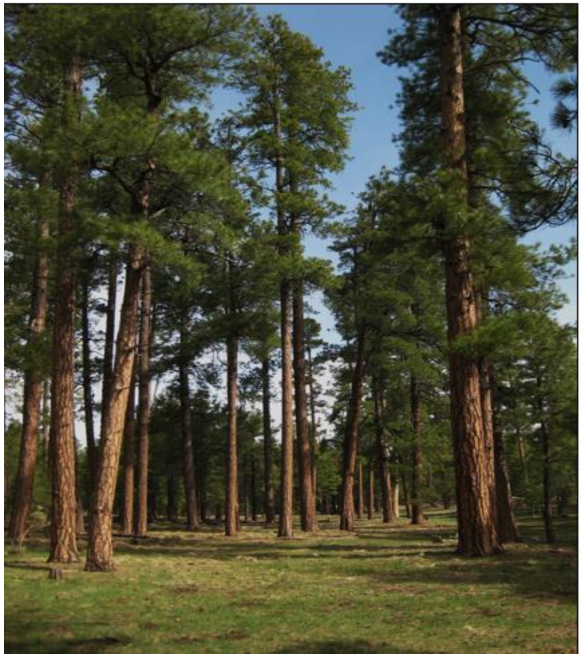
- Simply protecting large trees potentially misses key nuance
- **Managers can ask:**
  - where should fire-tolerant & intolerant old forests live on the landscape?
  - **create wildfire & CC resilient conditions around them, improve their residence time**
  - use age rather than DBH of fire-tolerant trees
  - **develop transparent monitoring protocols**
    - ✓ *concerned stakeholders can see observe methods implemented*
    - ✓ *observe ecosystem responses*

EARLY SERAL SPECIES:

- Treatments can increase abundance
- **In cases where repeated harvests have eliminated desired early seral species**
  - ✓ *severe fires or regen. harvests may be needed*
  - ✓ *remove competition from undesirable shade-tolerant trees*
  - ✓ *reduce seed rain*
  - ✓ *w/o treatment, stands continually dominated by shade-tolerant tree species*

OLD-GROWTH DEFINITIONS:

- Interim old-growth definitions were based on fire excluded stands
- **May be inadequate for ponderosa pine (PP), DMC, MMC forests**



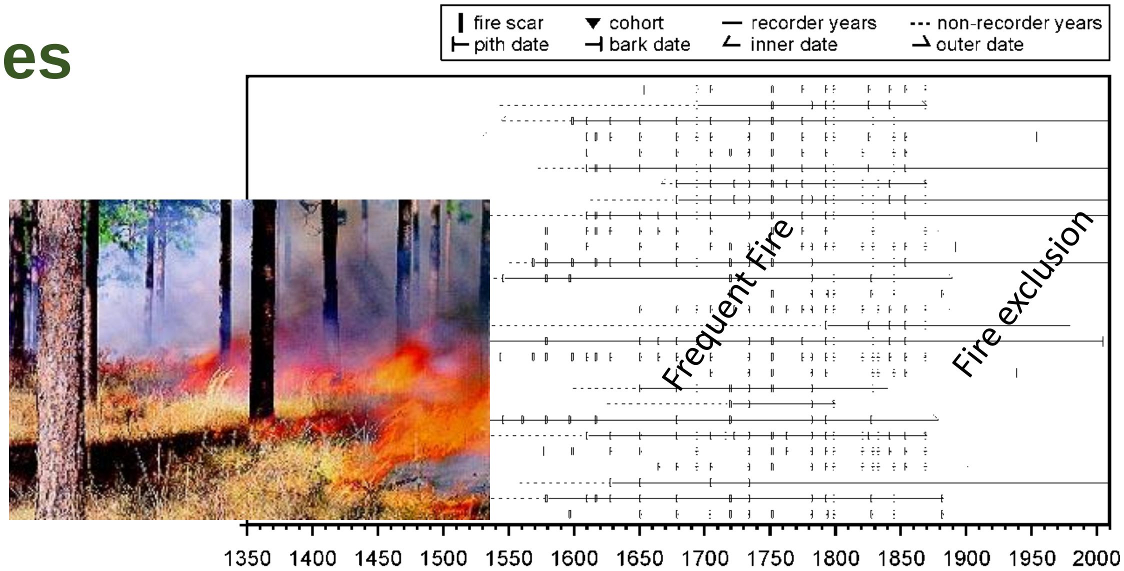
USDA
United States Department of Agriculture

Changing Landscapes, Ecological Values of Large/Old Trees, New Perspectives

Dr. Thomas Spies
Emeritus Scientist
PNW Research Station

Changes in Fire Regimes

- Less
  frequent fire in all regimes
- Higher proportion of high-severity fire compared to pre-Euro-American period in low severity regimes



New Understanding

- Some moist mixed-conifer sites had similar fire frequencies as dry-mixed conifer and pine sites

Changes in Large Trees

- Loss of large, old fire-resistant species e.g. ponderosa pine
  - logging
  - high-severity fire

Logging: 30-70% reduction in large old pines

High-Severity Fire

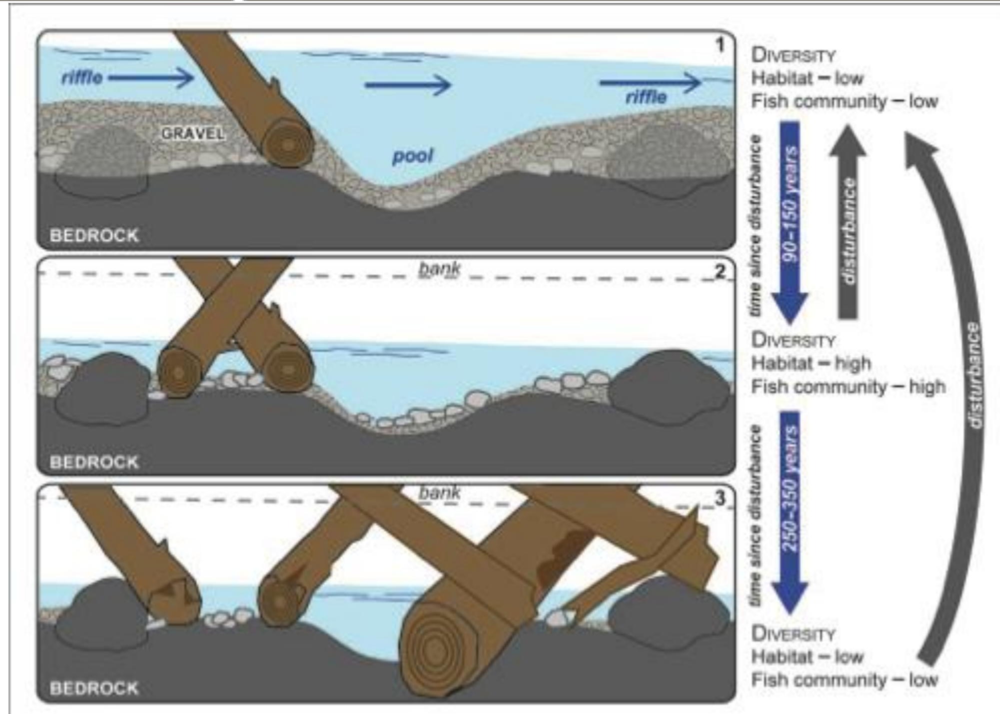
- Gain in large, shade-tolerant tree species (e.g. grand fir)
  - Fire exclusion
  - Can find 10-20 GF trees/ac >21” and less than 140 yrs old

Many Ecological Benefits of Old and Large trees

- Microclimate for plants and animals
- Rare fungi and lichens, very old trees
- Food and shelter for animals
- Biological legacies persist through disturbances
- Dead trees are valuable
- Tree species matter, e.g.
  - Nesting Northern goshawks and white-headed woodpeckers select ponderosa pine over grand fir
  - Snag fall and wood decay rates

Aquatic and Hydrological Functions of Large trees

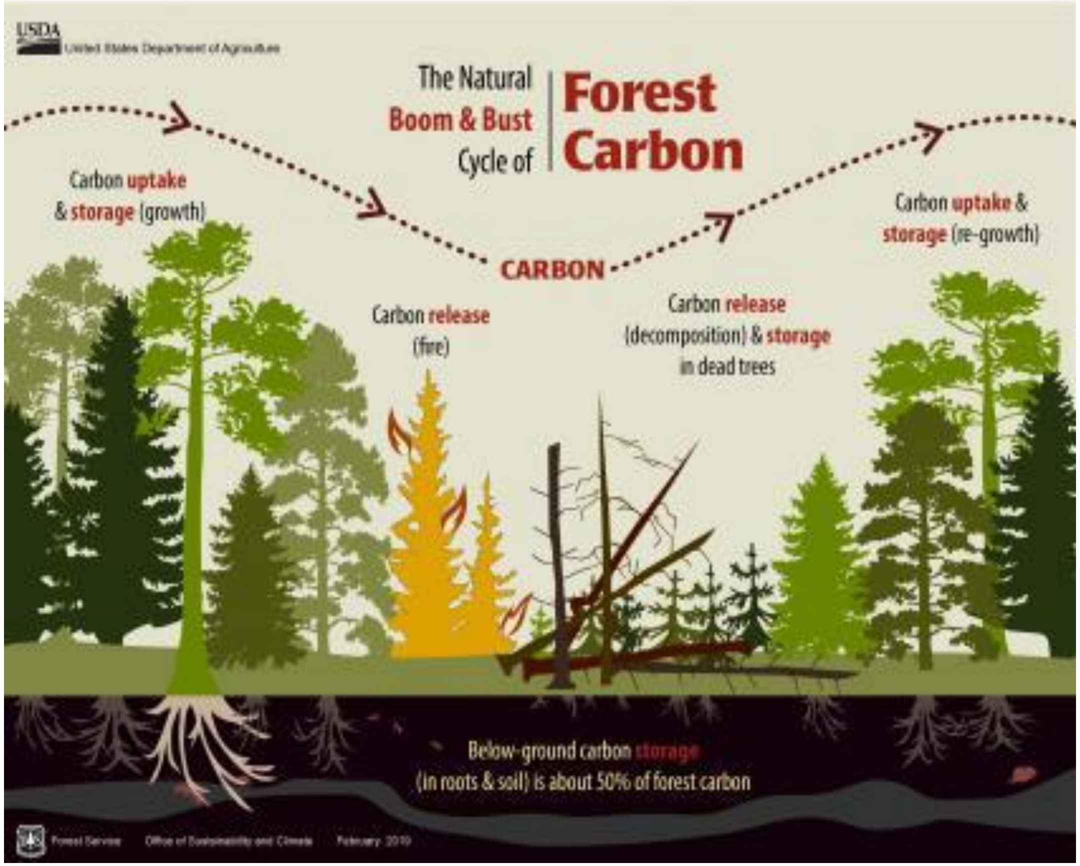
- Instream structure and habitat for fish
- Shade
- Influence floodplain development and heterogeneity



Forest Carbon

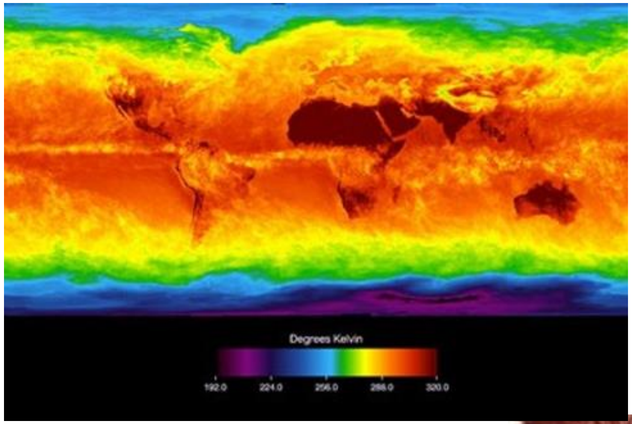
A complex story and area of active research

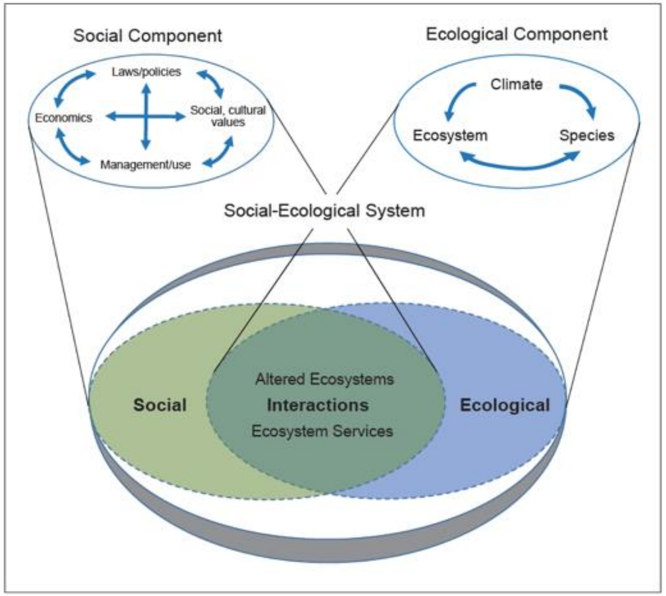
- Older forests, large live trees store high amounts of carbon
- Current degraded forests may store less carbon than forests under historical fire regimes
- Fuel treatments can help maintain carbon at stand scales-- **if they are following by wildfire**
- At landscape scales fuel treatment activities may reduce carbon compared to no management even if wildfires occur.
- Effects of changing climate?



New Context for Management

- New Threats
  - Climate change
  - Invasive species
- New Goals (e.g. Planning Rule)
  - Resilience to CC and fire
  - Coarse and fine filter approaches
  - Ecosystem services
- New Perspectives
  - Social-ecological systems
  - Interdependencies



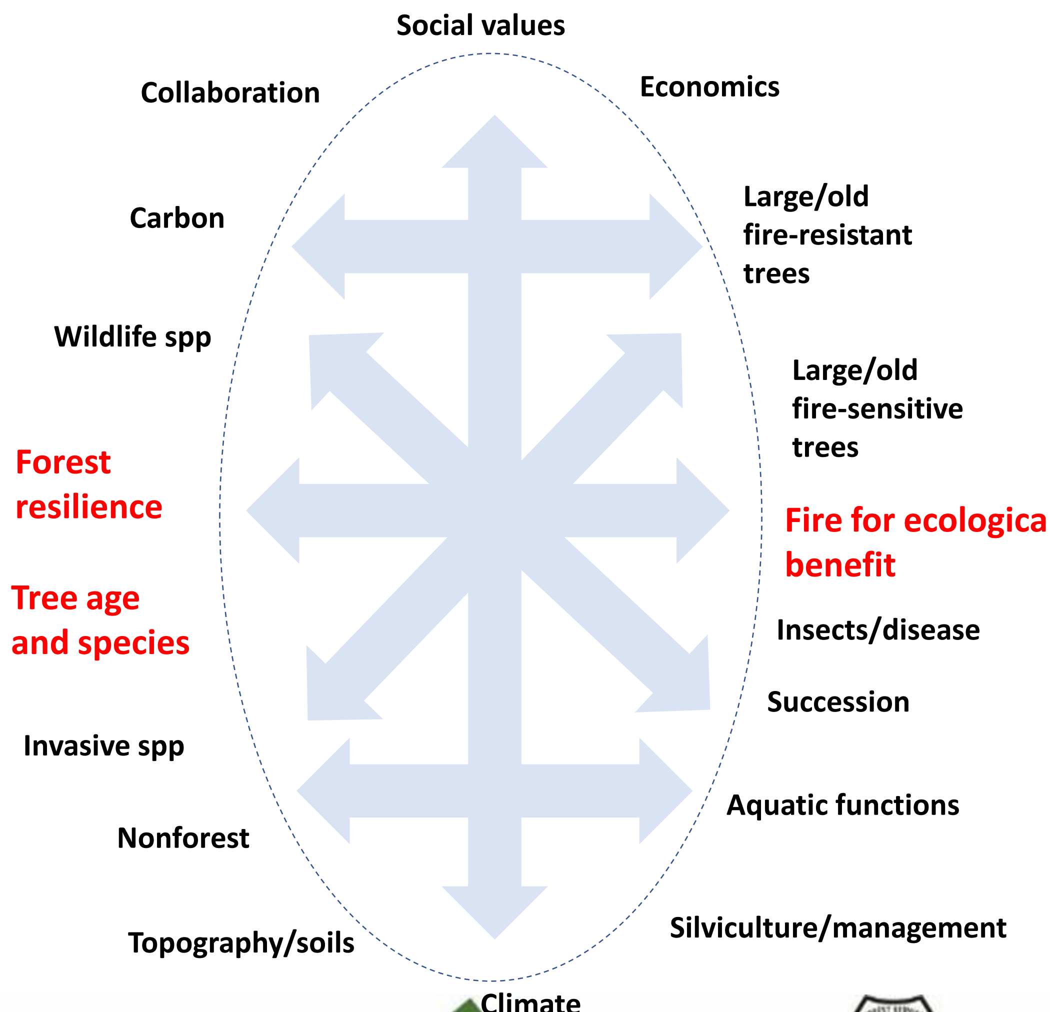


New Vision for Landscapes

Web of interactions: tradeoffs and synergies

Adding Resilience to the Mix

- Reduce tree density, promote large/old, fire/drought-resistant spp.
- Add tree age and species to guidance about large trees
- Increase fire for ecological benefits
- Identify tradeoffs and synergies
- Use landscape approaches
    - mitigate tradeoffs, find synergies
    - separate values in space and time
- Promote transparency and social engagement



Questions

Whiteboard Question

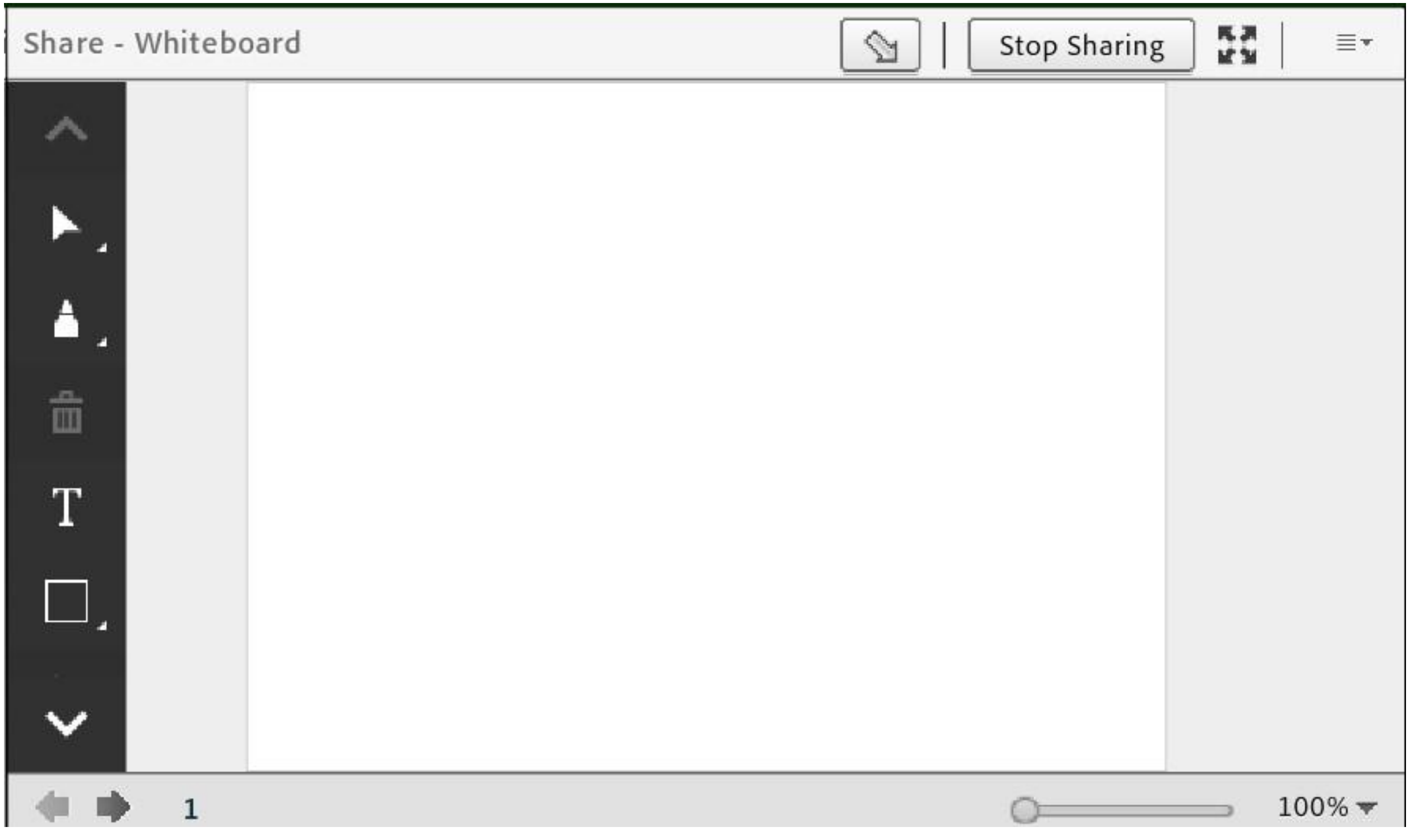
Please type on whiteboard your response.

What is your primary take-away from the information presented by our first panel?

Whiteboard

Selection

Text tool



What is your primary take-away from the information presented by our first panel?

There's a lot of new science that questions the utility of a blanket 21" limit

linked social ecological systems

Old trees are wonderful in every way.

Big trees are more important to forest health/resilience than small trees.

Big trees are valuable.

Species matter

soical and ecological values of trees and attitudes twoards preservation

high social and ecological value of old trees

Large not always old, and small not always young

age and species should be taken into account when preserving trees in a timber sale.

A simple one size all solution will be problematic

Large trees are important

Tree species matter

Thre is scientific evidence to not manage by size alone.

I appreciate the social science information

Large trees provide important ecosystem services

Landscape-scale view important and one-size fits all aproaches don't get the job done.

Age vs DBH

In the absence of old growth (which didn't grow back in 25 year) big trees are important.

•

Age is more important ecologically than diamater.

21" rule is too generic to allow effective response to today's forest conditions and needs.

21" paints with too broad a brush

some skype participants only see collaboration as representing their values

Age in addition to DBH

It's not just about forest health.. economics, etc...

It's complicated

Very complex science with too many variables for most people to understand.

We need to harvest larger trees

21 inch rule is antiquated

There has been lots of new insights in the recent 25 yrs, and there is also open minded perspective to change the old paradigm tradeoffs

nuances missed by current standard

21" rule is too generic to allow effective response to today's forest conditions and needs.

I did not hear an ecological rationale for removing fir over 21 inches in diameter ostenibly to curb wildland fires

Not all big trees are old -- not all old trees are big.
Species matter. Not all old trees are created equal

There has not been meaningful consideration given to strengthening the screens as the science panel suggested back in the 1990's

Landscape analysis can help us accomodate different values

Large trees provide important ecosystem services

Retain long lived serals, while reducing density

This is controversial and undermining public trust

Panel 1 - Questions & Answers

Susan Charnley
Research Social Scientist,
PNW Research Station.

Paul Hessburg
Research Scientist,
PNW Research Station

Tom Spies
Emeritus Research Scientist,
Pacific Northwest Region.

Welcome Panel 2

Dominick Della Sala
Geos Institute

Chad Hanson
John Muir Project

John Alexander
Klamath Bird Observatory

Bev Law
Oregon State University

EASTSIDE SCREENS ARE NEEDED TO PROTECT LARGE TREES, LARGE TREE COHORTS, AND LATE-SERAL FORESTS

Dominick A. DellaSala, Ph. D, Chief Scientist
Dominick@geosinstitute.org

Photo – Blue Mountains Biodiversity Project

GEOS INSTITUTE

www.geosinstitute.org

WHAT ARE "LARGE" EASTSIDE TREES & WHY IMPORTANT?

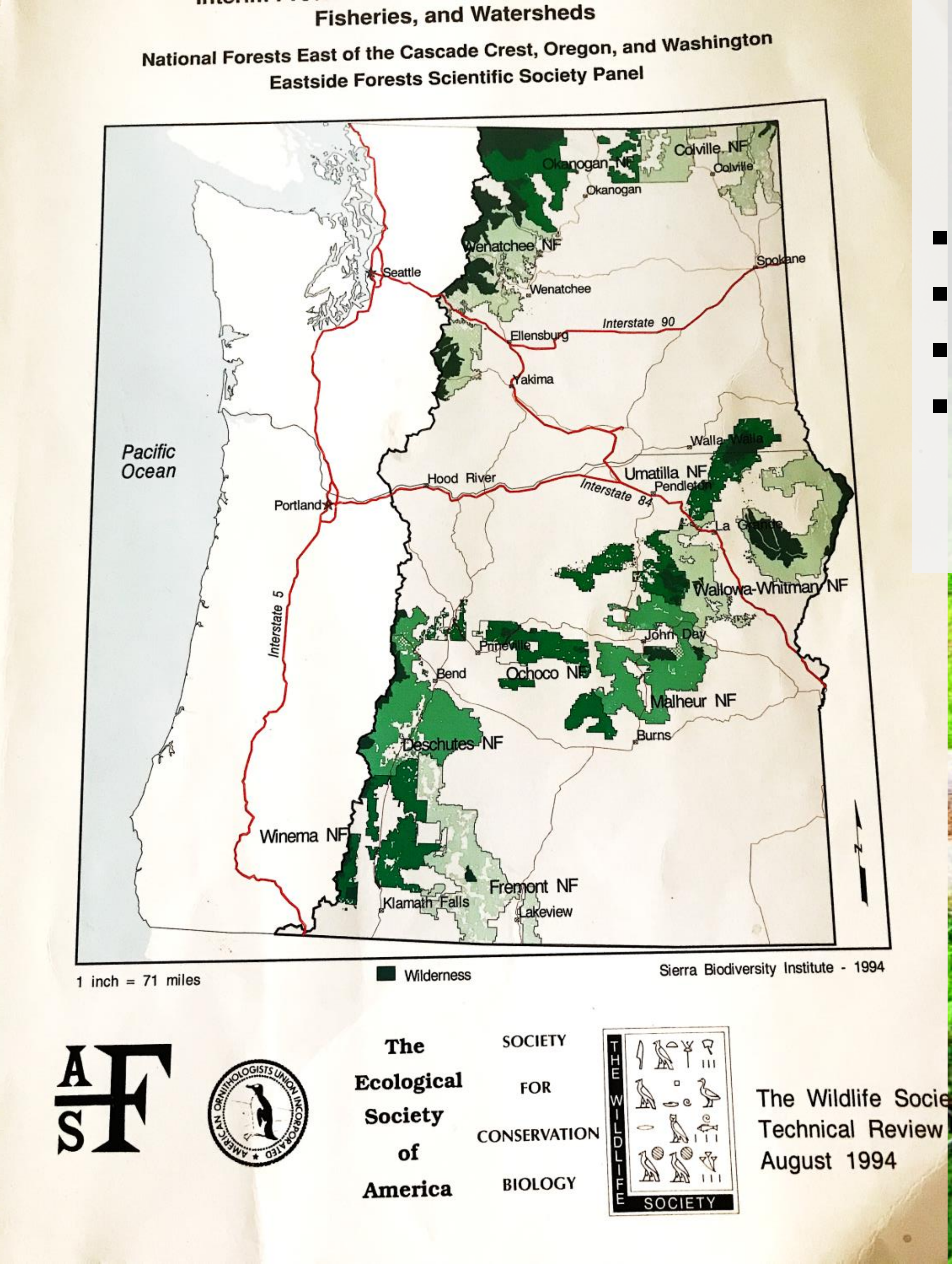
- **>20 in dbh regardless of species composition**
- **Deformities, cavities, brooms, mistletoe ("forest health")**
- **Few lower branches, thick bark – fire resistance**
- **Nesting, roosting, foraging habitat regardless of composition**
- **Carbon storage, aquatic structure, below ground processes**

Photo: Andy Kerr

WHAT ARE LARGE TREE COHORTS & WHY IMPORTANT?

- Single or multi-species large tree clusters that function as mini-ecosystems
- Below ground mycorrhizal connectivity, shared nutrients, chemical underground "communication" networks (Simard 2016)

Photo: Andy Kerr



WHY EASTSIDE SCREENS ARE NEEDED?
(eastern Oregon-Washington, 1936 surveys)

- **Eastside old growth extended to desert edge pre-logging**
- **Nearly 90% of forests in “saw-log,” 73% commercial forestlands**
- **Trees up to 60-70 in dbh dominated pine and mixed conifers**
- **Most stand volume in the 20-44 in dbh range (included dense firs) (Henjum et al. 1994, numerous historical accounts)**

WHY EASTSIDE SCREENS ARE NEEDED?

- Only 25% of 6 eastside forests in LS/OG condition compared to nearly 90% historic (Henjum et al. 1994)
- Commercial logging on a trajectory to reduce large (>20 in) trees to 10% of 1936 levels (Henjum et al. 1994)

- **Every large tree now matters because most are gone**

Photo: pinterest.com

FOREST SERVICE HISTORY OF WANTING "FLEXIBILITY" & DISCRETION
HAS BEEN ABUSED

- **1960s belief that LS/OG was "decadent" and needed to be "regenerated"**
- **1990s "forest health" belief that insects and fire risks can be reduced by logging**
- **1990s belief that certain forms of logging "mimic" natural disturbance processes**
- **2000s postfire logging late-successional reserves and roadless areas – "restore" old growth**
- **Expansion of Categorical Exclusion in NEPA – "active management" (code for logging)**
- **Trump's recent executive order = more logging and "active management"**
- **Standards hold the agency accountable**

Photo: Andy Kerr

IF FOREST SERVICE OPENS FOREST PLANS, THEN MUST RETAIN EASTSIDE SCREENS

- Start by reinstating 20-inch dbh as the standard (Henjum et al. 1994) – we give an inch, you take a tree
- Protect large tree cohorts for below-ground connectivity and ecosystem functionality
- Develop a reserve network based on redundancy, connectivity, coarse/fine filter (DellaSala et al. 2017)

Photo: Blue Mountains Biodiversity Project

Forest Service logging of large firs in upper elevation Umatilla National Forest

STANDARDS ARE NEEDED EVEN FOR LARGE FIRS

- Protect ecologically important areas where fir more suited and historically occurred in abundance

- Identify and protect refugia: north and east facing slopes, ashy soils, gulches, elevational connectivity, riparian (roadless areas, remaining LS/OG in reserve network)

- Wildlife don't care if fir or pine – marten, bats, goshawks, woodpeckers – large firs are all that's left in places

- Narrow exception (based on historical evidence) for encroached firs in canopy drip line of old pines - girdle, fell, or tip into streams (bull trout, steelhead) – no yarding of large trees

Photo: Blue Mountains Biodiversity Project

FOREST SERVICE AND SCIENTISTS FAIL TO ADDRESS STRESSORS COMPREHENSIVELY

- Cows and climate change major stressors on public lands (Beschta et al. 2012)
- Fire suppression and logging exacerbate fire intensity (Bradley et al. 2016)
- Roads contribute ignitions, aquatic impacts, habitat fragmentation, invasives (Ibisch et al. 2017)
- Thinning alters stand dynamics (blow down, invasives, fire spread) and increases emissions (Bev Law's work)
- Post fire logging interrupts natural successional processes (Lindenmayer et al. 2008)
- Use historical baseline: trees >60 in dbh with most stands in 20-44 in dbh (pre-logging)

Photo: pinterest.com

Some Citations (more available upon request)

Historical Evidence (https://bluemountainsbiodiversityproject.org/historical-documents-summary-of-forest-density-and-species-composition-on-the-malheur-national-forest/)
Bright, G., 1913. The Relative Merits of Larch and Douglas Fir in the Blue Mountains, Oregon. Accessed online at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev7_015570.pdf
Matz, F. 1928. Malheur River Timber Survey Project Malheur National Forest Service 1927. Accessed online at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5413616.pdf
Matz, F., 1934. Descriptive Report Middle Fork John Day River Timber Survey Project Whitman National Forest 1930. Accessed online at: https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5381973.pdf
Merritt, M., 1910. Head Watershed Middle Fork John Day River Whitman National Forest 1910. Accessed online at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev7_015531.pdf
Miles, H., 1911. Annual Silvicultural Report Malheur National Forest 1911. Accessed online at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev7_015584.pdf
Starker, T., 1915. Recommendations for Cutting Inferior Species on the Whitman National Forest, Oregon January 15, 1915. Accessed online at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5414184.pdf
Henjum, M.G., et al. 1994. Interim protections for late-successional forests, fisheries, and watersheds: National forests east of the Cascade crest, Oregon and Washington. The Wildlife Society, Bethesda, MD.

Contemporary Research
Beaver, E., S. Prange, and D.A. DellaSala. 2020. Disturbance ecology and biodiversity. CRC Press Taylor and Francis Group: Boca Raton, FL.
Beschta, R.L., et al. 2012. Adapting to climate change on western public lands: addressing the impacts of domestic, wild and feral ungulates. Environmental Management DOI 10.1007/s00267-012-9964-9
Bradley, C.M., et al. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western United States? Ecosphere 7:1-13.
DellaSala, D.A., et al. 2017. Accommodating mixed-severity fire to restore and maintain ecosystem integrity with a focus on the Sierra Nevada of California, USA. Fire Ecology 13:148-171.
DellaSala, D.A. 2020. Fire-mediated biological legacies in dry forested ecosystems of the Pacific Northwest, USA. Pp. 38-85, In: E.A. Beaver, S. Prange, D.A. DellaSala (eds). Disturbance Ecology and Biological Diversity. CRC Press Taylor and Francis Group, LLC: Boca Raton, FL.
Ibisch, P.L., et al (multiple authors). 2017. A global map of roadless areas and their conservation status. Science 354:1423-1427.
Simard S. 2016. https://www.ted.com/talks/suzanne_simard_how_trees_talk_to_each_other
Lindenmayer, D.L. et al. 2008. Salvage logging and its ecological consequences. Island Press: Washington, DC

Why Thin?

Chad Hanson, Ph.D.

P.O. Box 897, Big Bear City, CA 92314
Phone: 530-273-9290   Email: cthanson1@gmail.com
www.johnmuirproject.org

Hessburg et al. (2007) findings for historical mixed-conifer forests of the eastern Cascades:

- “low, mixed, and high severity fires occurred on 16, 47, and 37% of total forest area, respectively”

- “evidence for low severity fires as the primary influence, or of abundant old park-like patches, was lacking in both the dry and moist mixed conifer forests.”

Complex early seral forest is comparable to old-growth in terms of native biodiversity and wildlife abundance (DellaSala and Hanson 2015).

Current high-severity fire rotation intervals are several hundred years longer, overall, than historical intervals in the eastern Cascades and Blue Mountains (Baker 2015).

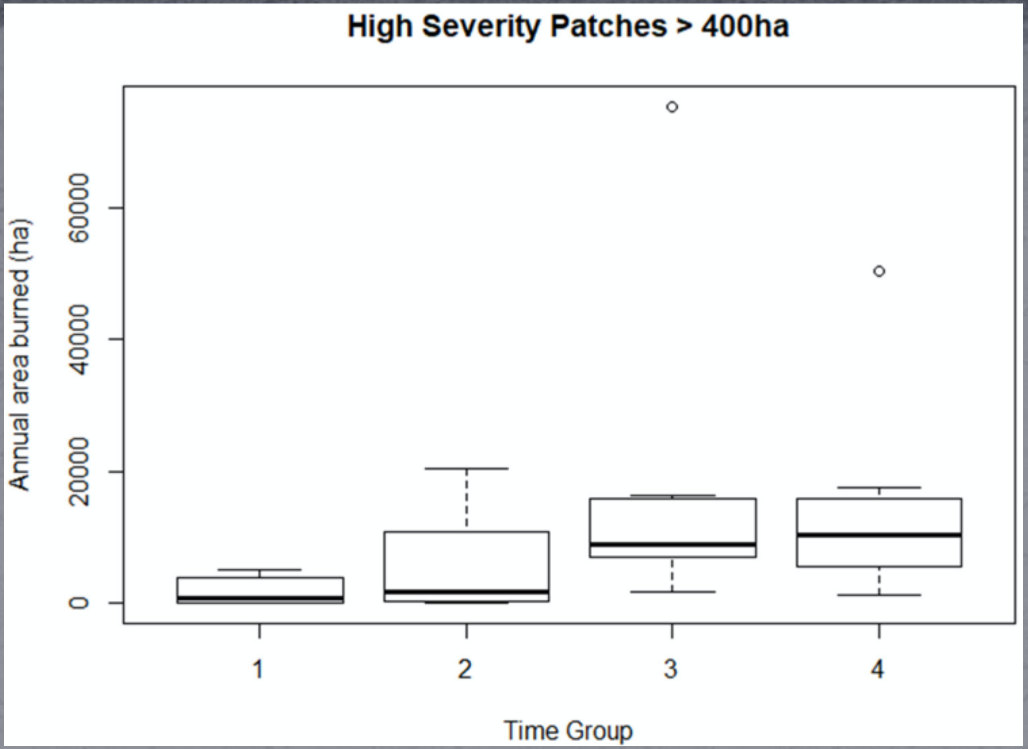
In other words, there is currently less high-severity fire than there was historically.

Keyser and Westerling (2017): "While some studies have shown increasing fire season length, we saw no significant increase in high severity fire occurrence…We found no correlation between fraction of high severity fire and total fire size, meaning increasing large fires does not necessarily increase fractional high severity fire area."

Law and Waring (2015): No significant increase in high-severity fire in PNW forests.

DellaSala and Hanson (2019): No increase in large high-severity fire patches since 1990s. Abundant historical evidence of large high-severity fire patches.

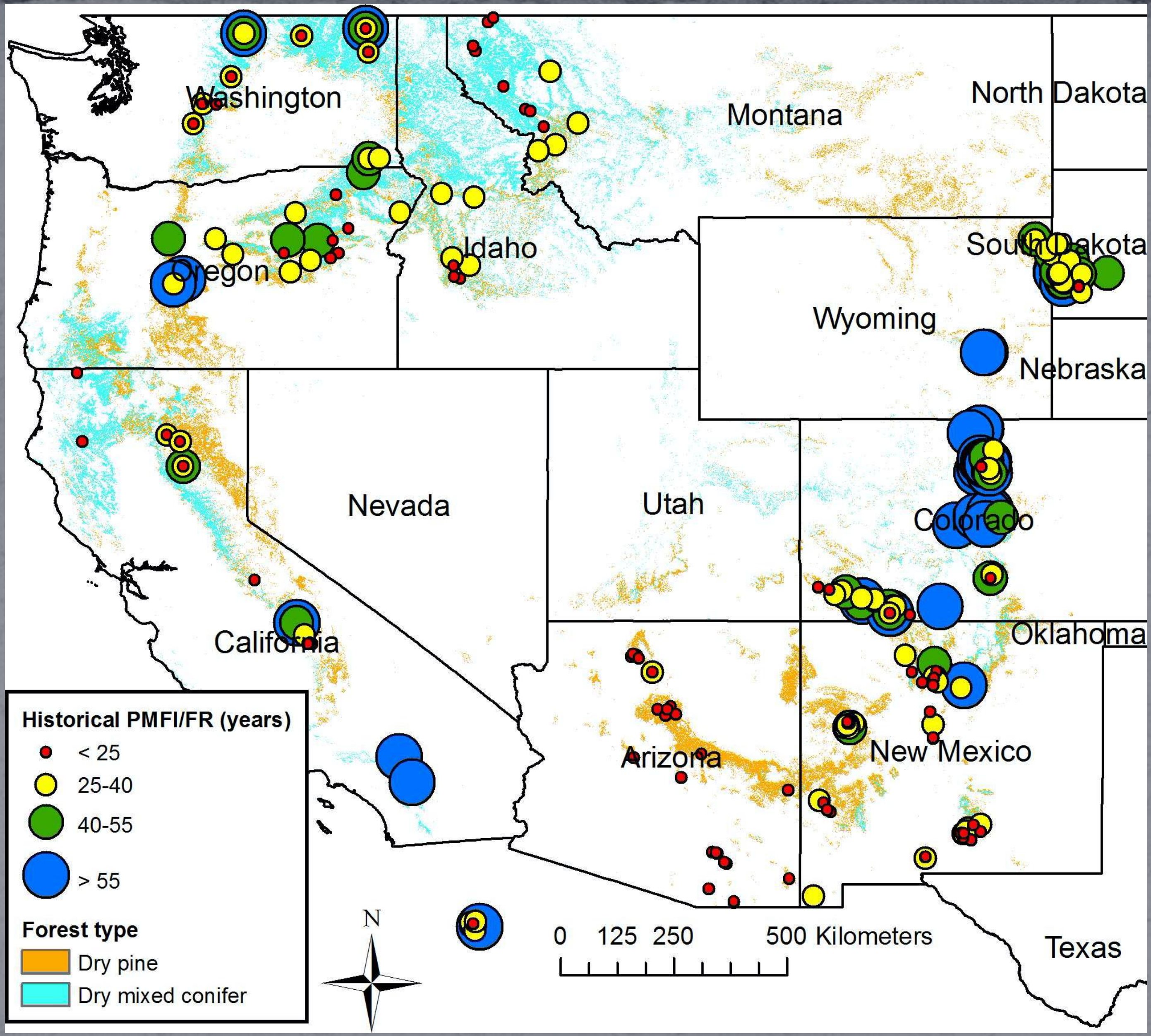
DellaSala and Hanson (2019)



Large patch rotation intervals extremely long: over 2 millennia.

Table 4. Percentages of the total area within the boundaries of CESF patches >400 ha, created by high-severity fire, that were at increasing distances from unburned or low/moderate-severity edges and inclusions.

Distance (m)	Sierra-Nevada/ Southern-California	Klamath/ Southern-Cascades	Northern-Cascades/ Northern-Rockies	Southern-Cascades/ Southwest
<100	49.3	55.6	46.8	54.7
101–200	27.6	25.5	25.2	26.0
201–300	13.5	11.2	12.8	10.6
>300	9.6	7.7	15.3	8.7


Washington
Montana
North Dakota
Oregon
Idaho
South Dakota
Wyoming
Nebraska
Nevada
Utah
Colorado
California
Oklahoma
Arizona
New Mexico
Texas
Historical PMFI/FR (years)
< 25
25-40
40-55
> 55
Forest type
Dry pine
Dry mixed conifer
N
0 125 250 500 Kilometers

Baker (2017)

Jon C. Fremont’s 1845 Journals Describe More Dense Forests Than Open Forests in Blue Mountains

Page 547-548: “After travelling occasionally through open places in the forest, we were obliged to cut a way through a dense body of timber, from which we emerged on an open mountain side…”

Page 548: “We continued to travel through the forest, in which the road was rendered difficult by fallen trunks, and obstructed by many small trees, which it was necessary to cut down…A laborious day, which had advanced us only six miles…”

Page 548: [the following day] “The trail passed sometimes through very thick young timber, in which there was much cutting to be done; but, after travelling a few miles, the mountains became more bald…”

Page 549: “…descending a bad ravine, into which we drove our animals, and had much trouble with them, in a very close growth of small pines.”

Page 549: “After cutting through two thick bodies of timber…the forest became more open…The pines here were 11 or 12 feet in circumference…”

Williams and Baker (2012): Historically, “in the Blue Mountains, 42.9% and 19.3% of the landscape had > 18% and > 30% firs.”

Baker (2012): In historical forests of the eastern Oregon Cascades, forest density varied widely—over half had more than 100 trees/acre over 4” in diameter, and up to 650/acre.

Baker et al. (2018): It is uncontested that historical USFS surveys underreported conifer density by more than twofold.

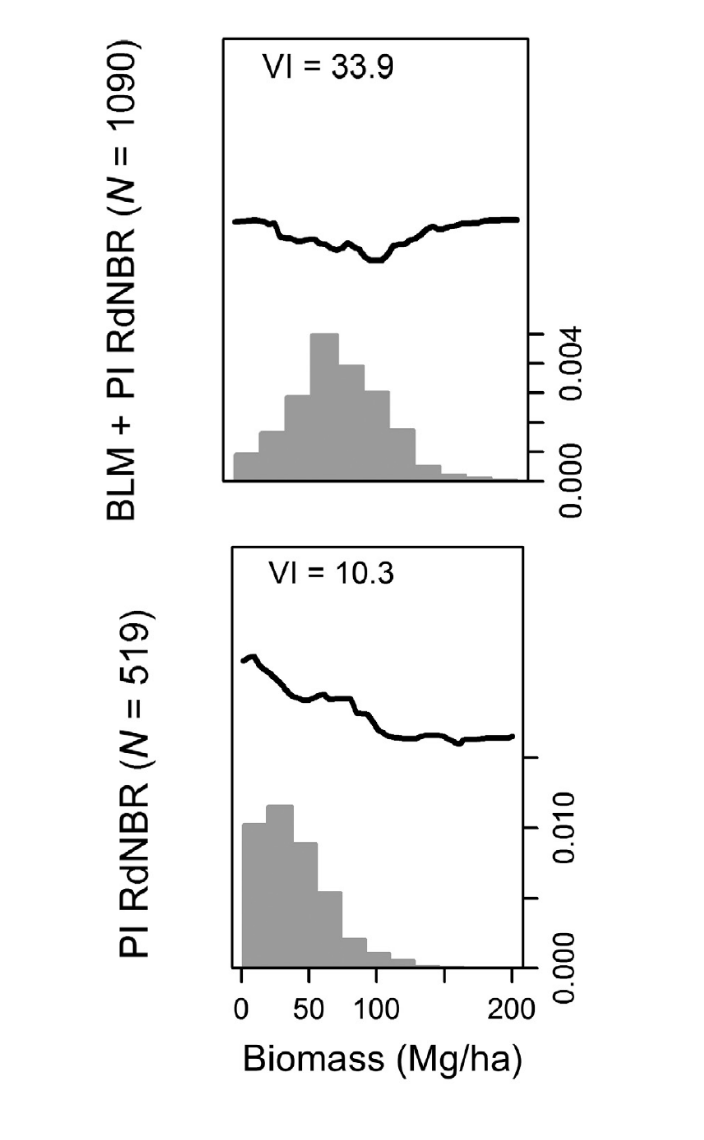
Forest Density is Poorly Correlated to Mortality:

Blue Mountains, Cochran and Barrett (1995):

"there was no apparent correlation between stand density and mortality"

Eastern OR Cascades, Cochran and Barrett (1999):

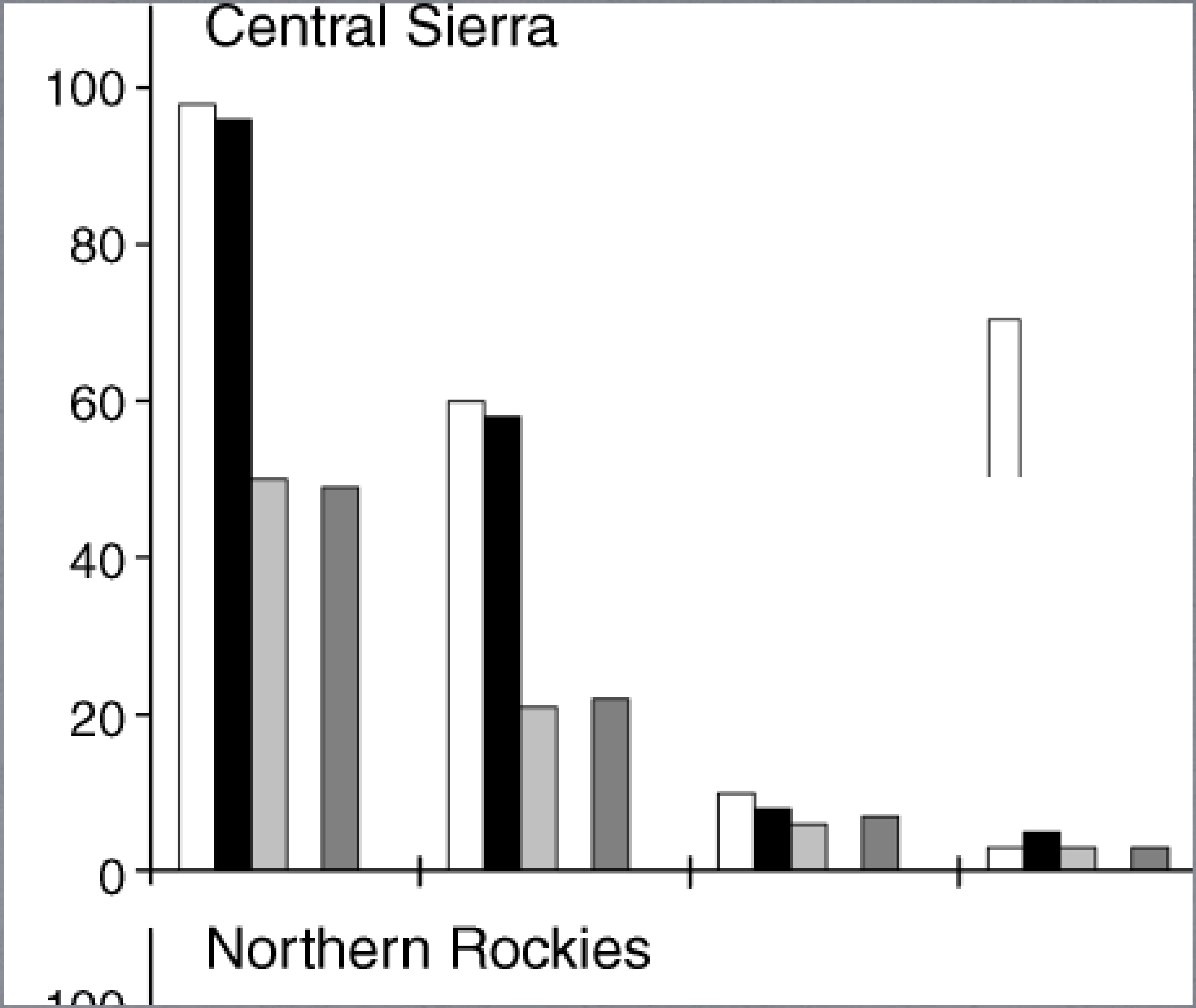
Ponderosa pine stands go through a period of moderate tree mortality from competition and native beetles when they are of intermediate age but, after about 85 years of age, annual tree mortality in these stands drops to near zero, even as they continue to grow denser.



Zald and Dunn (2018)

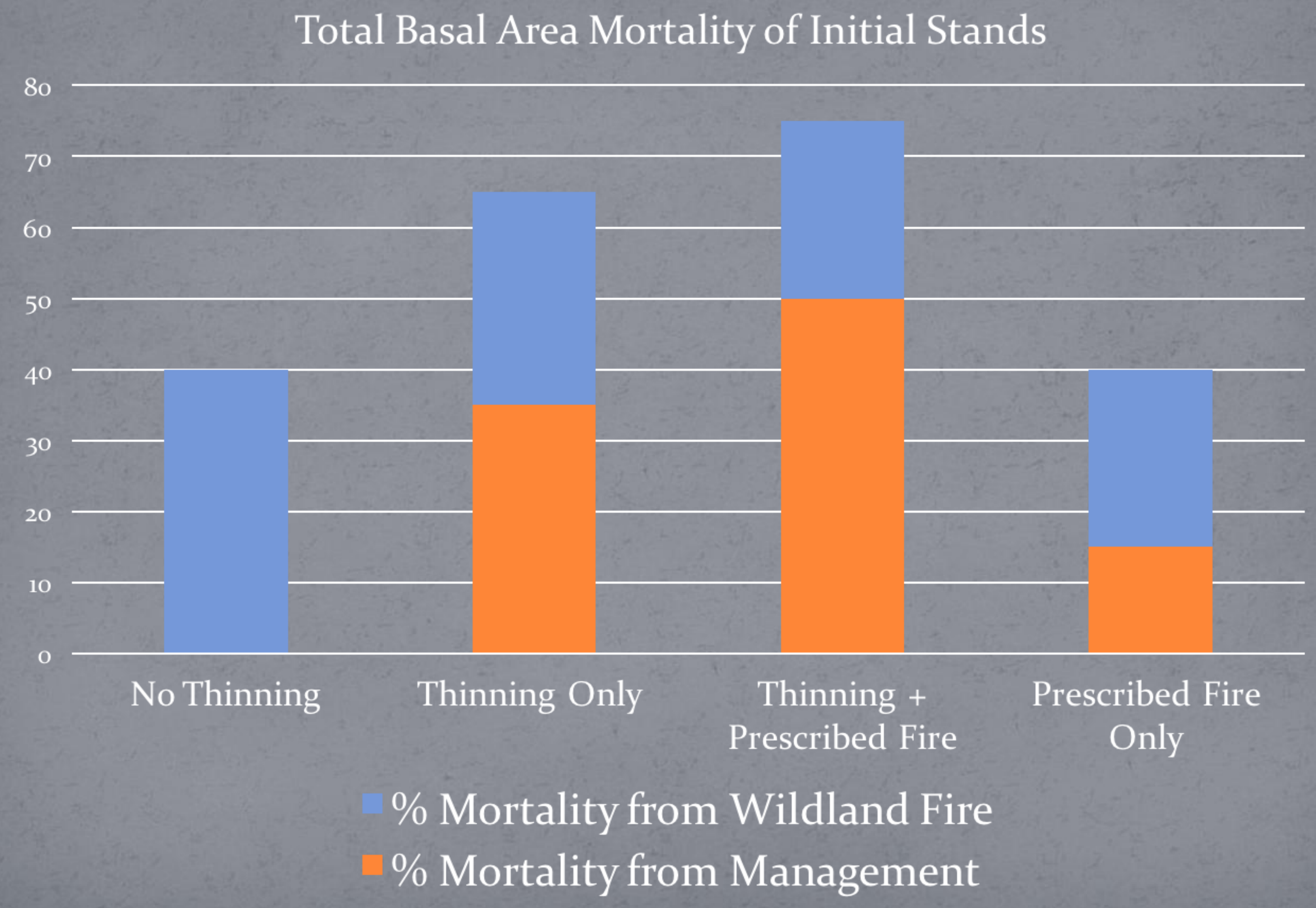
From Stephens et al. (2009), 90th Percentile Fire Weather

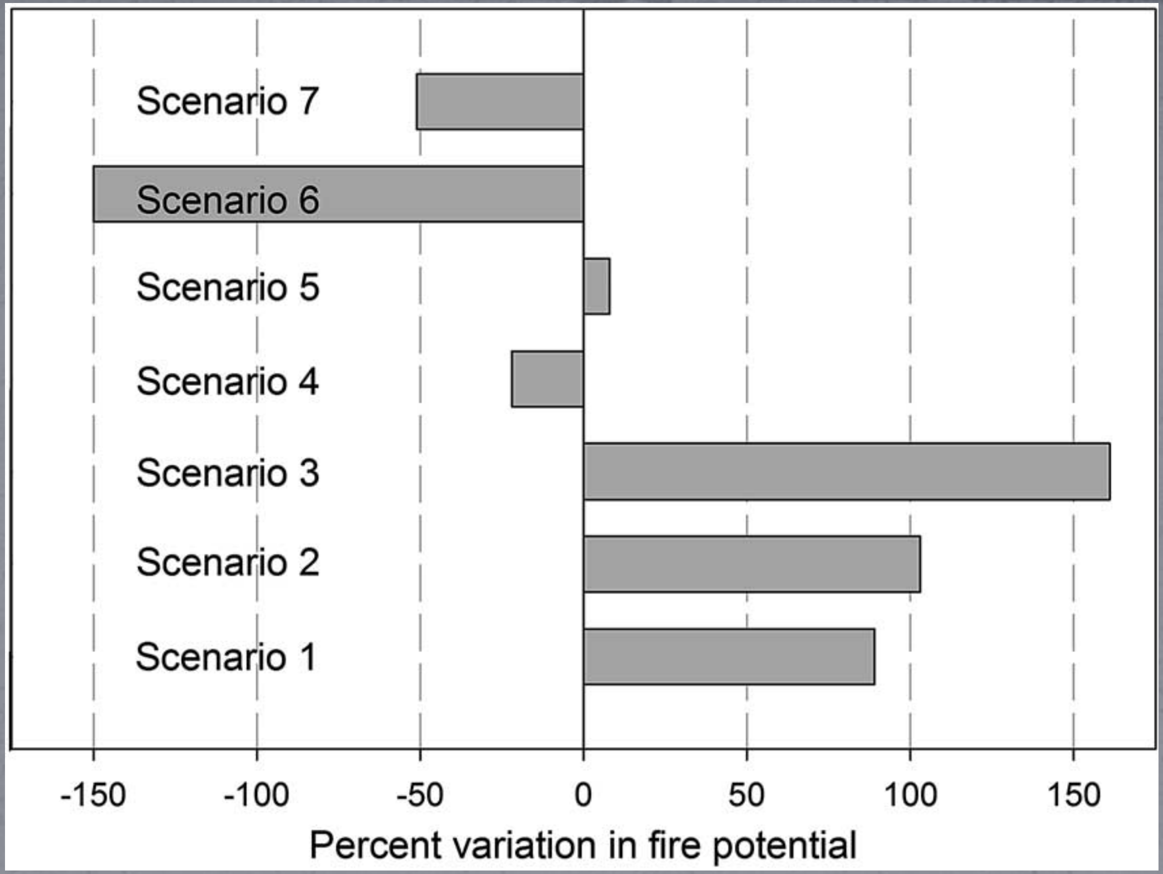
% Tree Mortality



Tree Diameter (centimeters)

Calculated from Stephens et al. (2009), 90th Percentile Fire Weather, Blue Mountains





Cruz et al. (2014)

See also Prichard et al. (2020)—fire severity increased in most thinned areas.

Birds-eye View: Conservation of the East Cascade Forest Ecosystems

John D Alexander, Bob Altman, and Jaime L Stephens

Klamath Bird Observatory

American Bird Conservancy

Partners in Flight · Partenaires d'envol · Compañeros en vuelo

Forest Service U S Department of Agriculture

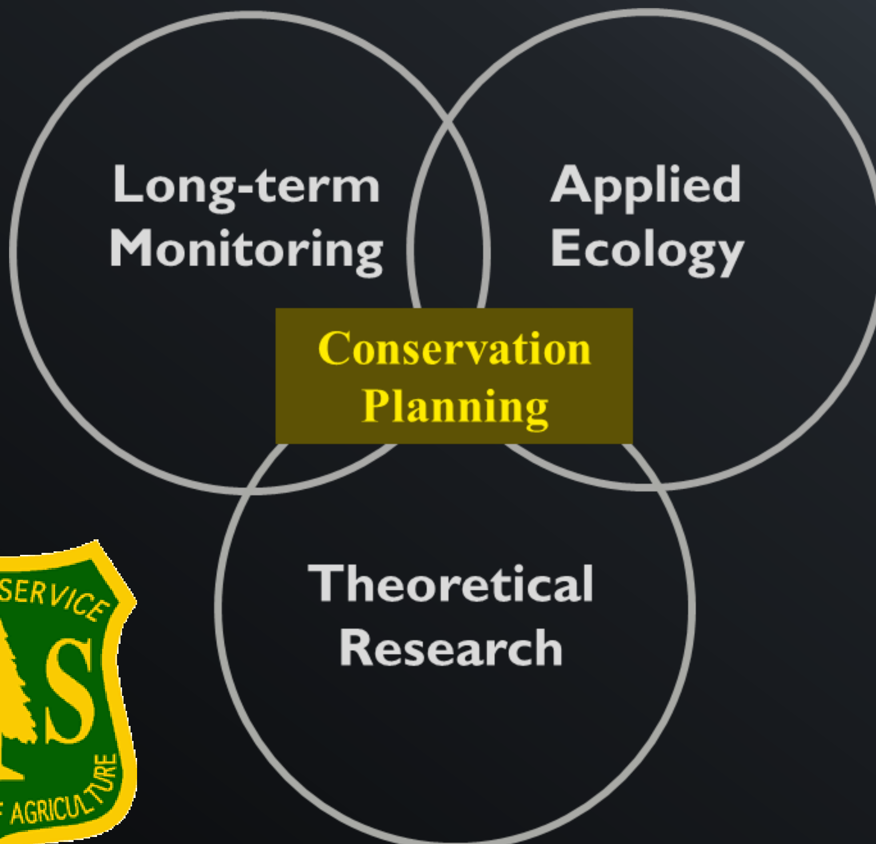
USDA United States Department of Agriculture

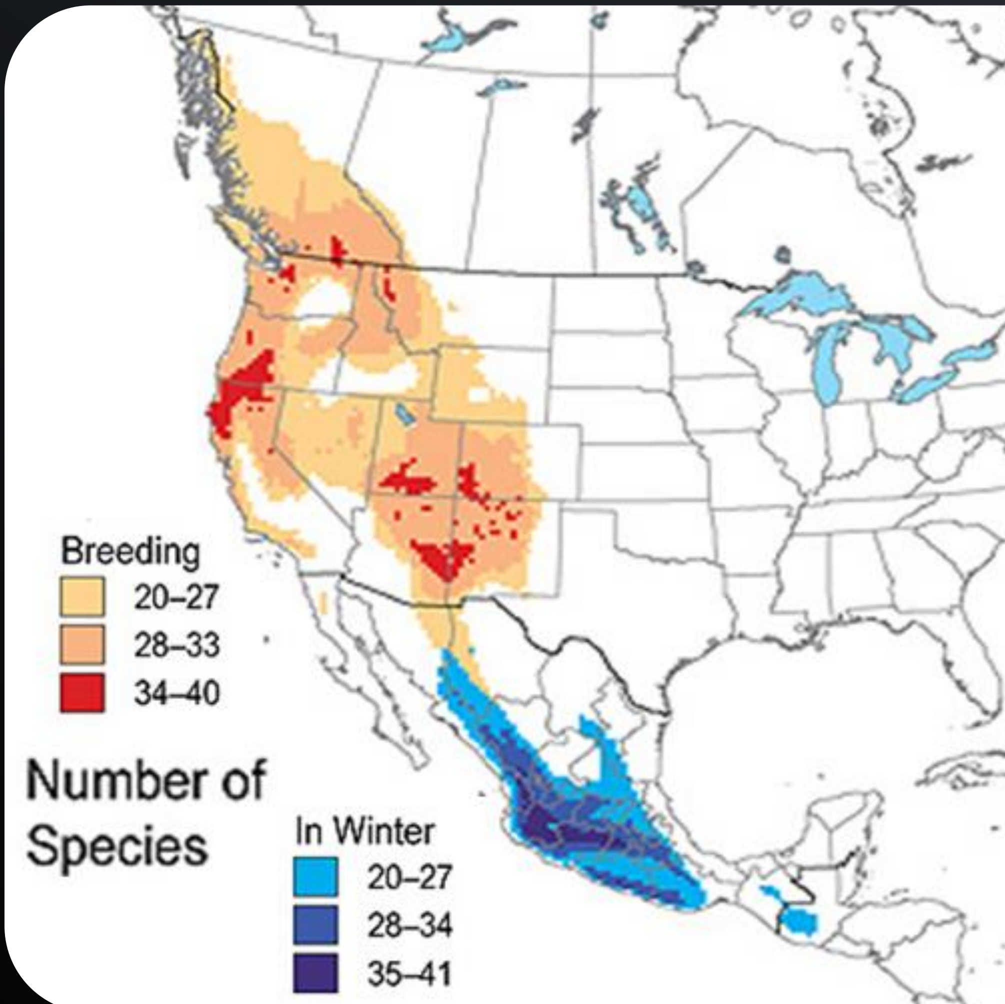
Science Forum: Adapting the Wildlife Standard of the Eastside Screens (21” standard)

May 11, 2020

Klamath Bird Observatory

Advancing bird and habitat conservation through science, education, and partnerships





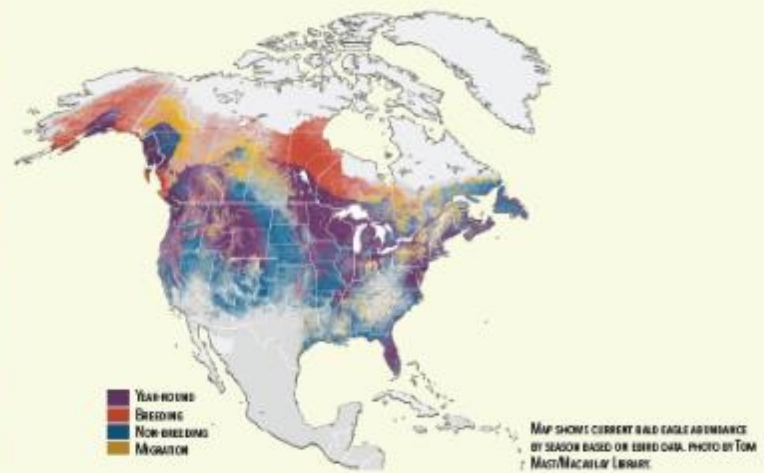
Voluntary partnerships:

- ***Keep common birds common***
- ***Help species at risk***

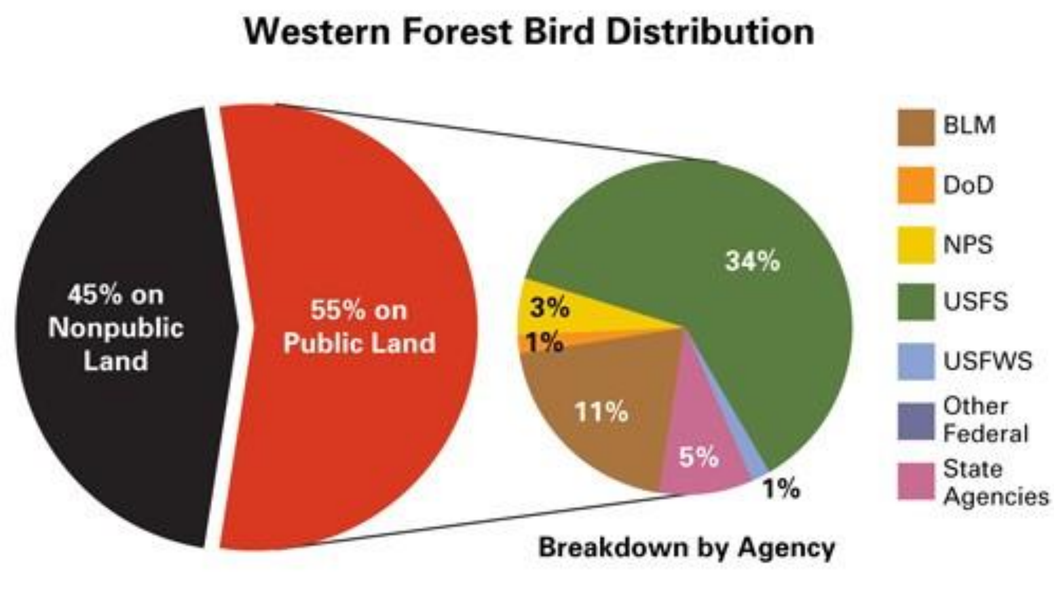
(Berlanga et al 2010; Rosenberg et al 2016) nabci THE STATE OF THE BIRDS 2019 | UNITED STATES OF AMERICA

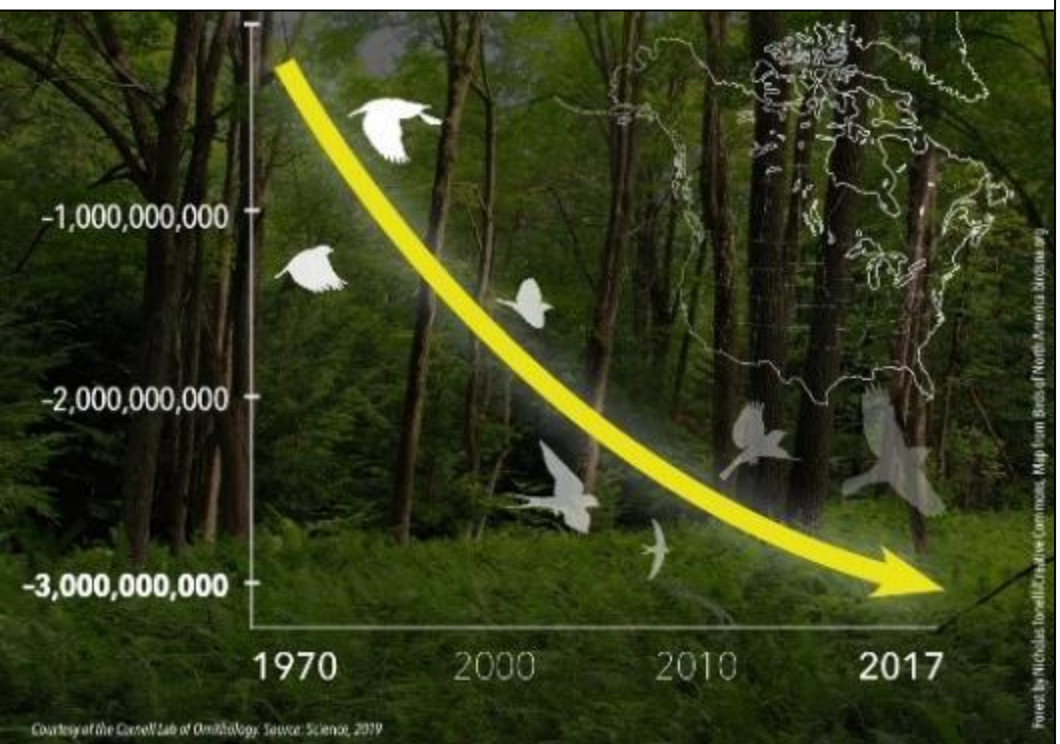
BUT CONSERVATION WORKS!

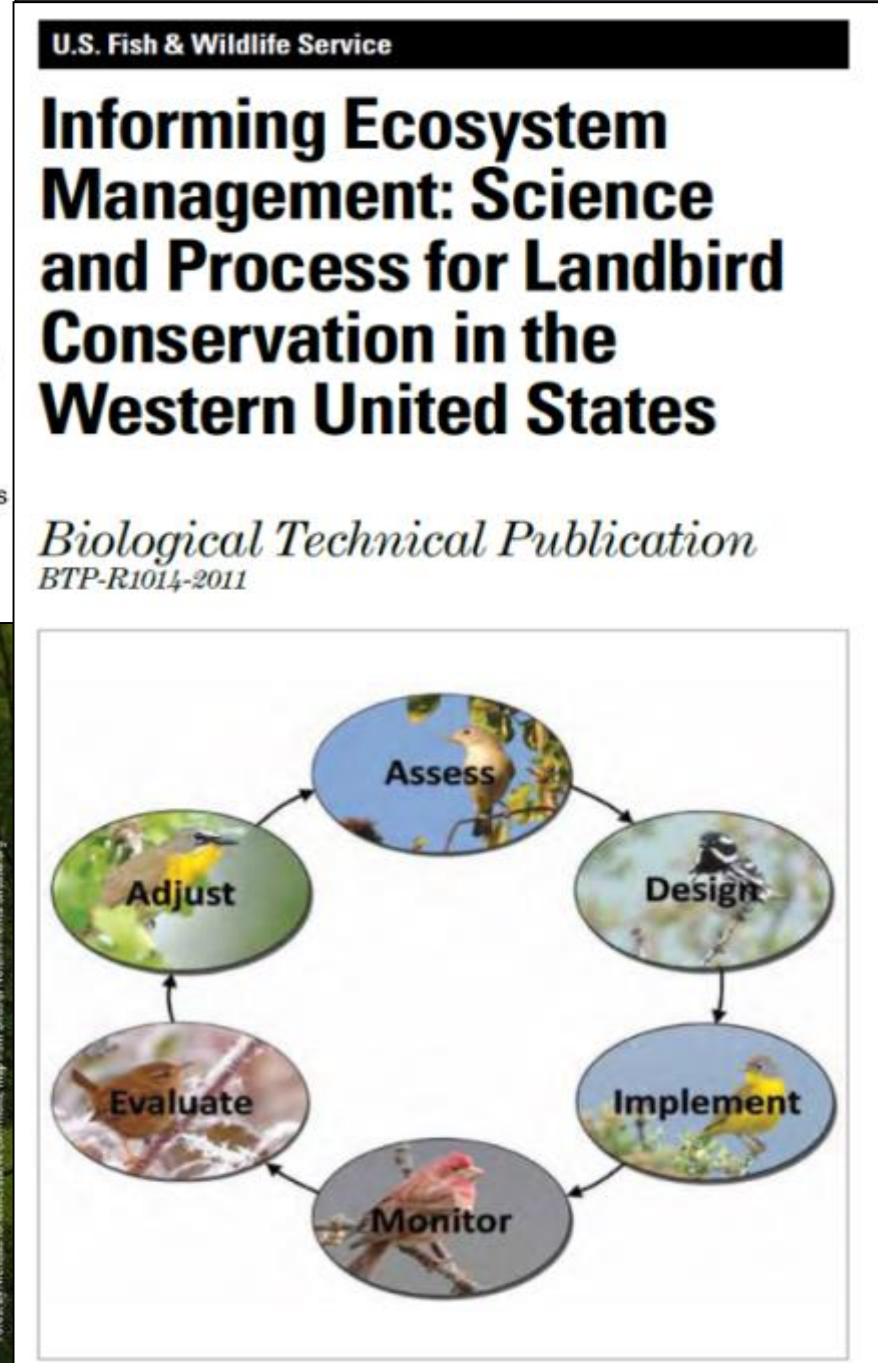
RECOVERY IS POSSIBLE WHEN WE INVEST IN BIRDS



(Rosenberg et al 2019; NABCI 2019, 2011)

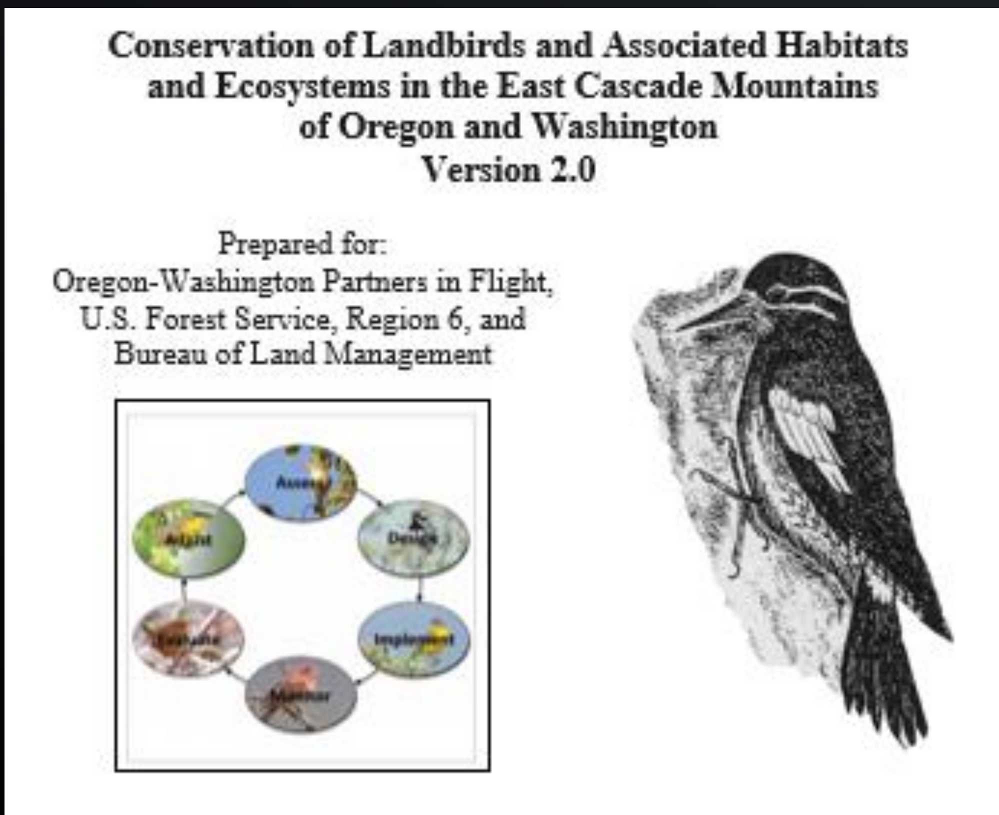






(Rosenberg et al 2019; Stephens et al 2011; Alexander 2011)

OR-WA Partners in Flight: Conservation Plan Update


Conservation of Landbirds and Associated Habitats and Ecosystems in the East Cascade Mountains of Oregon and Washington
Version 2.0

Prepared for:
Oregon-Washington Partners in Flight,
U.S. Forest Service, Region 6, and
Bureau of Land Management

PRIORITY & RESPONSIBILITY SPECIES:

Stop western forest bird population declines

FOCAL (INDICATOR) SPECIES:

Inform and measure restoration effectiveness

(Altman and Stephens 2020)

Priority Habitats

- **Dry Forest (ponderosa pine types)**
- **Mesic Mixed Conifer (late-successional)**
- **Pine-Oak**
- **Unique Habitats:**
  - post-wildfire
  - montane meadows
  - aspen
  - mature lodgepole and juniper

(Altman and Stephens 2020)

Dry & Mesic Mixed Conifer Forest

Highest Priority -- Late-Successional Forest

- Maintain existing late-successional forest with >30% old-growth (20-30% of landscapes)
- Restore where <20% of landscape
  - Increase patch size and connectivity
- Post-wildfire -- >40% naturally regenerating

Focal species --

ecologically appropriate ranges of variability

(Altman and Stephens 2020)

Dry Forest

HABITAT ATTRIBUTE	Large patches Late-successional Heteroenious Cover	Large Trees	Herbaceous understory Regenerating pine	Large snags
Focal Species	**WHWO**	**PYNU**	**CHSP**	**MOBLWEBL**
Species to Benefit	**PYNU** **FLOW** **GRFL** **WISA** CAFI GGOW NOGO PIJA PISI	**WHWO** **LEWO** CAFI GGOW PIJA PISI	**GRFL** GTTO	**PYNU** **WHWO** **LEWO** **MOCH** **OSFL** **WISA** PYNU VASW


:Photos – Livaudais (Altman and Stephens 2020)

Mesic Mixed-conifer Forests

HABITAT ATTRIBUTE	Large snags	Forest edges Openings - scatteredtrees	Multi-layered High understry volume	Large snags	Interspercerd herb openings Patches dense trees
Focal Species	**BRCR**	**OSFL**	**SWTH**	**WISA**	**FLOW**
Species to Benefit	**OSFL** **WISA** **RNSA** CAFI EVGR GGOW NOGO PIJA PISI	**BBWO** **CHSP** **WWPE** CAFI EVGR GGOW RNSA	**HETH** CAHU GTTO MOQU RUHU	**MOBL** **MOCH** **OSFL** **RNSA** GGOW TTWO VASW	**CHSP** **WHWO** **GRFL** GGOW

:Photos – Livaudais, Cornell Lab Altman and Stephens 2020)

Unique Habitats

HABITAT	Aspen	Montane Meadow	Mature Riparian
Focal Species	**ATFL**	**NAWA**	**LEWO**
Species to Benefit	**<u>LEWO</u>** **WEBL** GGOW	**SWTH** **CAHU** GTTO MOQU RUHU	**<u>ATFL</u>** **WEBL** GGOW VASW

:Photos – Livaudais Altman and Stephens 2020)

Large Trees and Snags

Dry Forest Population Responses

Fifteen Priority, Responsibility, & Focal Species

Big Tree Retention

Eleven positive

Snag Retention & Creation

Nine positive

(Altman and Stephens 2020)

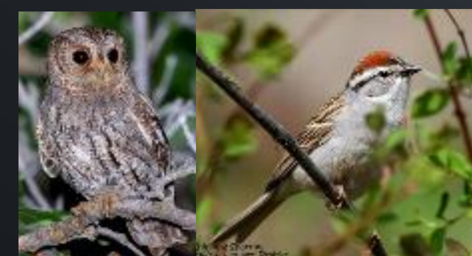
Large Trees and Snags

Dry Forest Population Responses

Fifteen Priority, Responsibility, & Focal Species

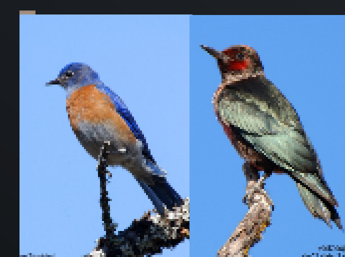
Decreasing Crown Density

1-6 negative; 5-8 positive



Understory Thinning

0-1negative; 8 positive



Surface Fuel Reduction

2-4 negative; 5-8 positive

(Altman and Stephens 2020)

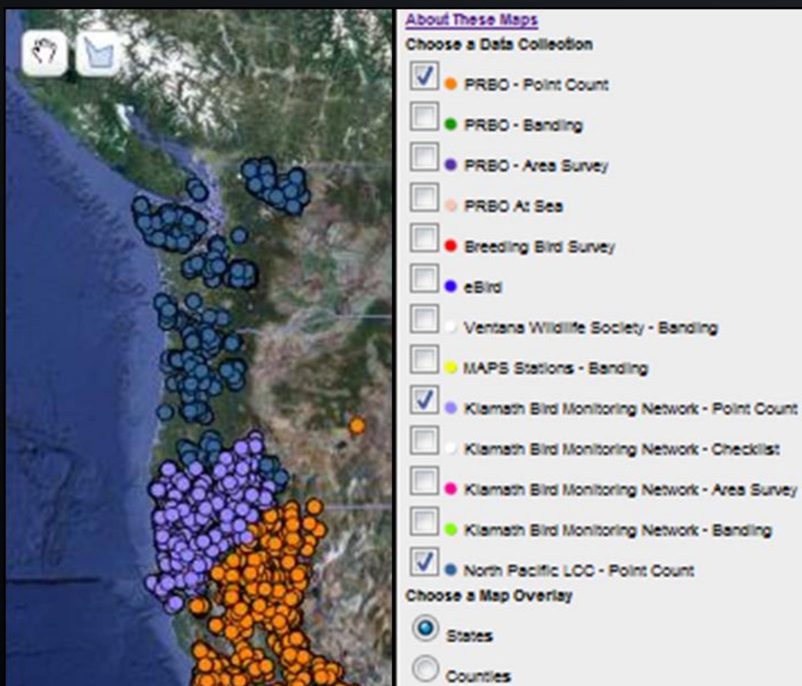
Adapting the Standard

Maintain and increase late successional and old growth forest conditions

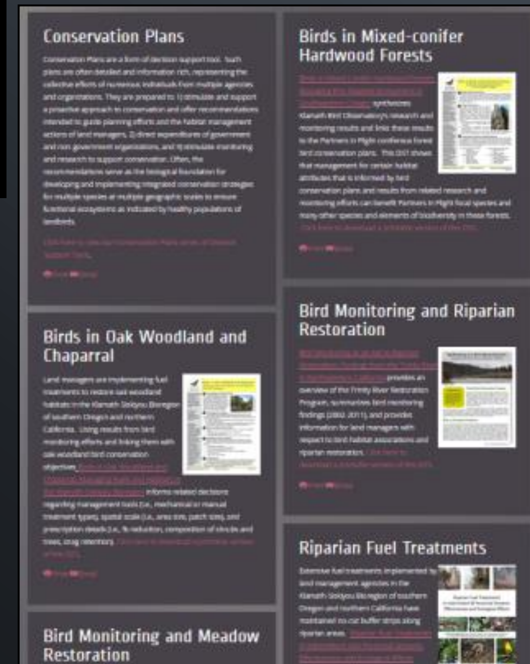
Meet conservation objectives – habitats and populations

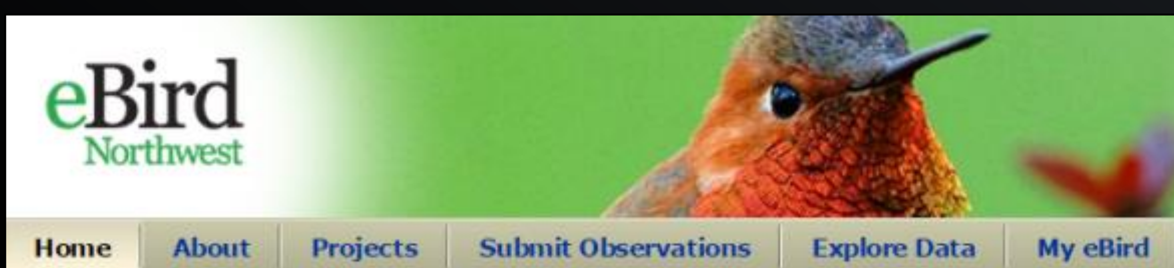
Ecological monitoring using birds as indicators

(Altman and Stephens 2020)



Avian
Knowledge
Network





(ADDITIONAL CITATIONS)

Birds-eye View: Conservation of the East Cascade Forest Ecosystems

John D Alexander, Bob Altman, and Jaime L Stephens

Science Forum: Adapting the Wildlife Standard of the Eastside Screens (21” standard)

May 11, 2020

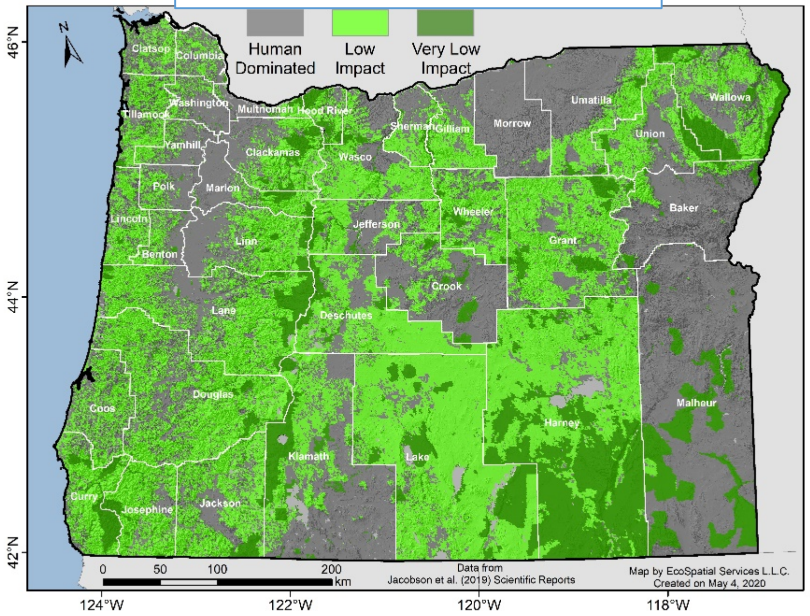
Forest Carbon and Climate Mitigation

Beverly Law, Emeritus Professor Global Change Biology & Terrestrial Systems Science

Oregon State University

- Land-use strategies to mitigate climate change using natural climate solutions is a priority of international policy
- Low human impact forests have the most potential to *keep carbon out of the atmosphere* by allowing them to grow to their biological carbon sequestration potential
- Expanding protected areas is critical for mitigating climate change, preserving biodiversity

Oregon Human Impact

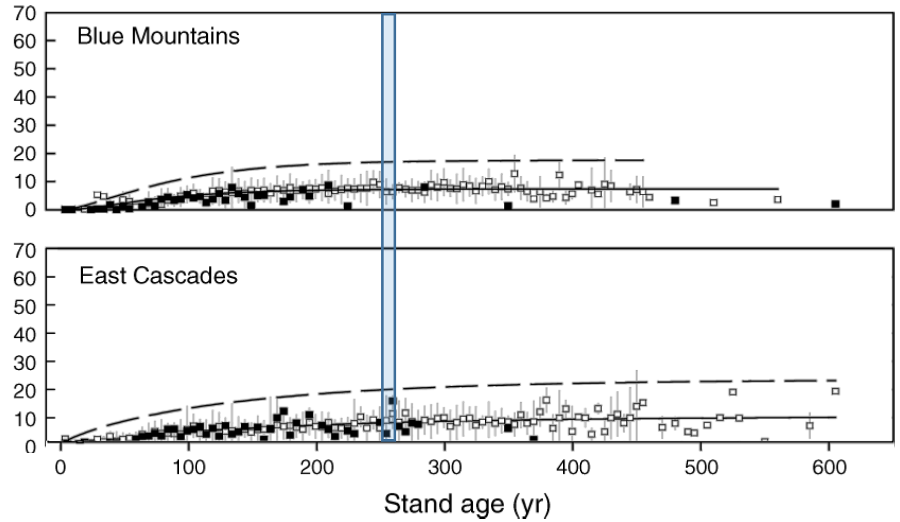


([1,2]Moomaw et al. FEE 2019, [2]Jacobson et al. Sci Rep 2019, [3]Buotte et al. Ecol App 2020, [3]Law et al. PNAS 2018)

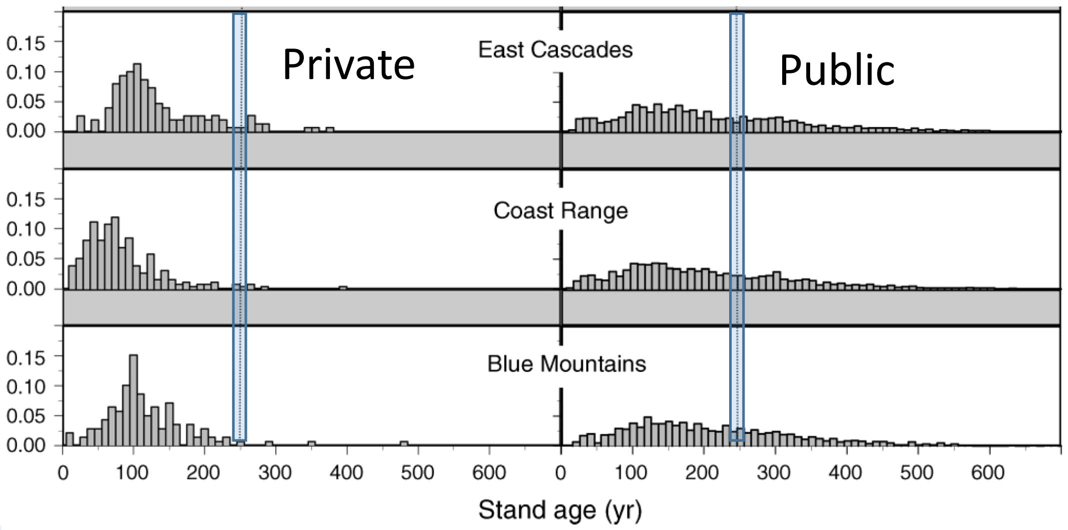
Forest Carbon and Climate Change – Role of Big Trees

- Large trees have been keeping carbon out of the atmosphere for centuries
- US forests: largest 1% of trees account for ~30% of biomass C
- E side 6 NFs: 21+ inch trees account for ~5% of trees, but ~20% of live biomass C
- If larger diameter trees are removed, it will reduce carbon storage and take >100 y to attain

Live biomass (Kg C / m^2) (open=public)



Frequency distribution FIA plots age > 250y (vertical line)



Ecoregion	FIA, Public lands STAND AGE at max biomass
Blue Mountains	180
East Cascades	310

(Law et al. 2001, Hudiburg et al. 2009, Lutz et al. 2018)

Drought stress is more severe in young than mature and old ponderosa pine

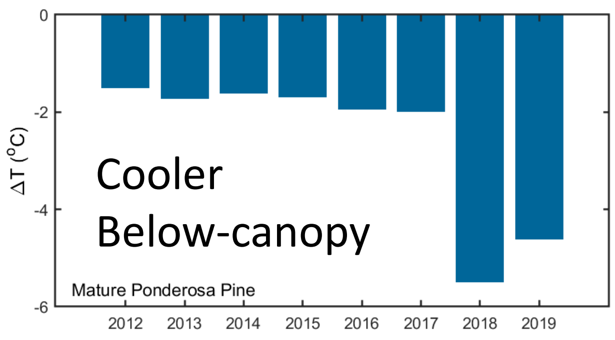
Young pine stands are potentially more vulnerable to future drought and heat extremes

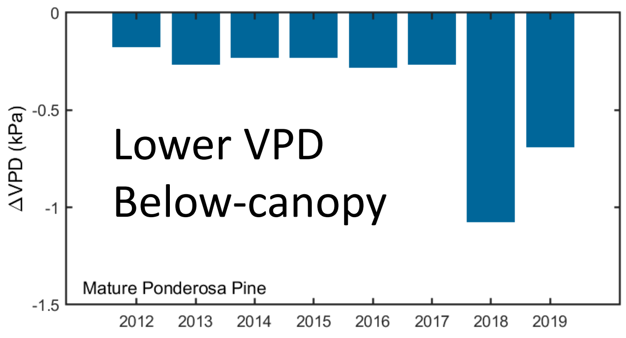
Young stands are net sources of CO_2 to the atmosphere for first 15-20 y after stand replacing disturbance

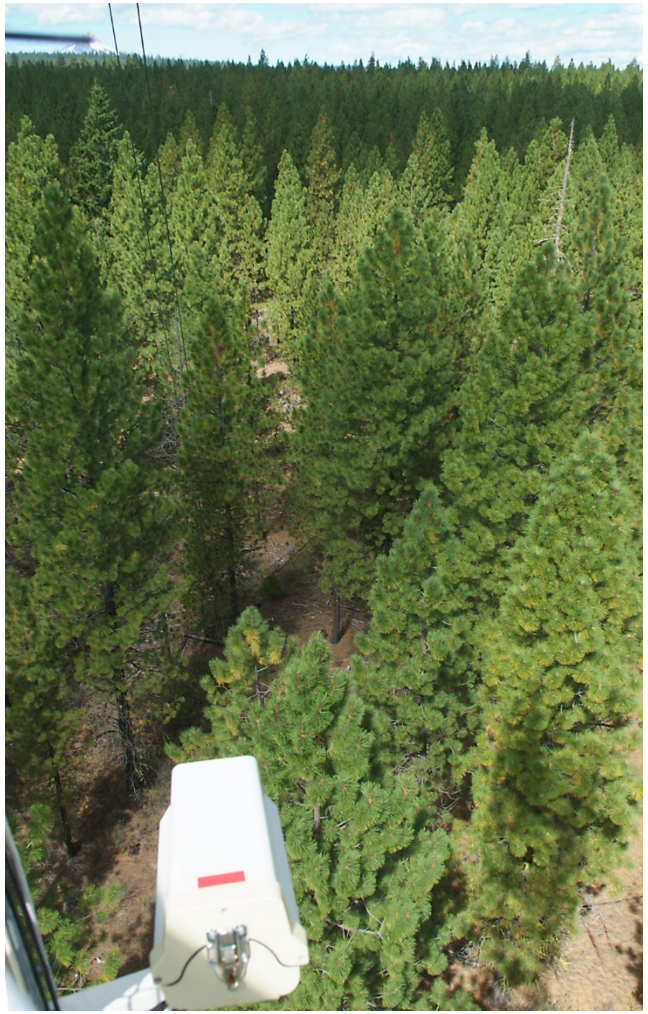
(Vickers et al. Tellus 2012, Irvine et al. 2002, Amiro et al. 2010)

Thinning Effects

- Thinning reduces carbon stored in forests
- Thinning produces more emissions than most fires
- Older forests with complex canopies provide cooler, lower VPD microclimates better suited to withstand climate extremes
- Removing large trees reduces crown cover and microclimate buffering capacity







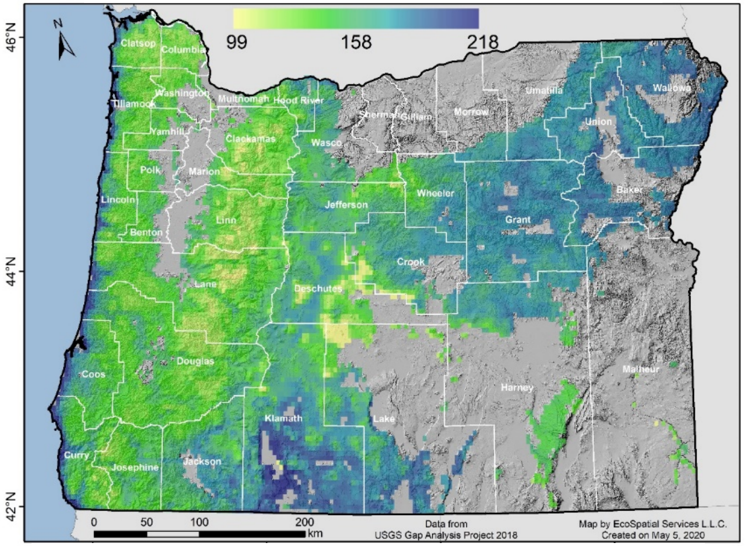
AmeriFlux ponderosa pine site (B.E. Law, PI)
Mean age of largest trees is >100 y

([1]Zhou et al. meta-analysis BGS 2013, [2]Campbell et al. 2012, Hudiburg et al. 2013, [3]Davis et al. 2019, [3]Frey et al. 2016, [3]Law et al. 2001, [3]Anthoni et al. 2000)

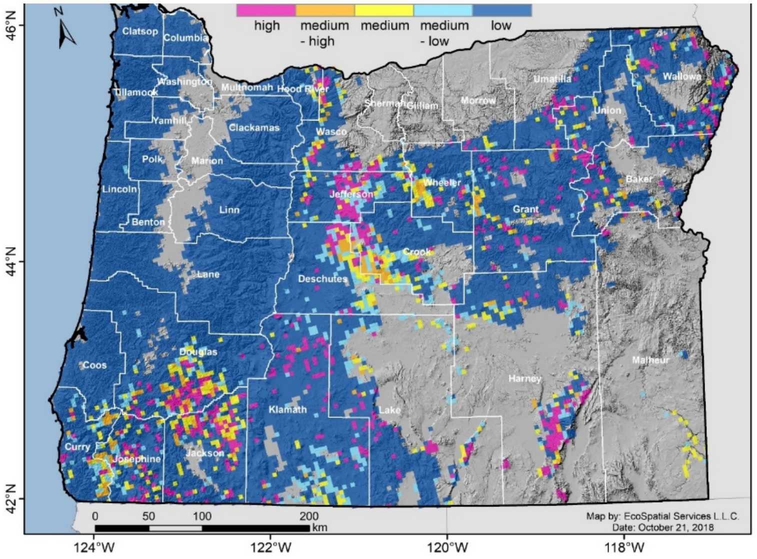
Species Richness

Oregon's forests have the potential to continue to support biodiversity in the future and promote climate resilience while protecting carbon stores.

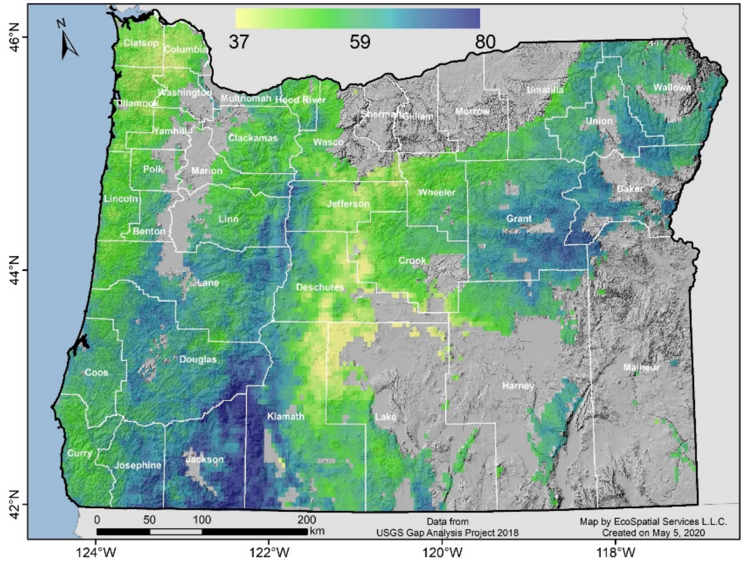
Forest bird species richness



Future vulnerability to drought or fire



Forest mammal species richness



(Buotte et al. 2019, 2020)

Citations

- Amiro, B.D. et al. 2010. Ecosystem carbon dioxide fluxes after disturbance in forests of North America. JGR 115, G00K02, doi:10.1029/2010JG001390.
- Berner, L.T., B.E. Law, A. Meddens, J. Hicke. 2017. Tree biomass mortality from fires, bark beetles, and timber harvest during a hot, dry decade in the western United States (2003-2012). Environ. Res. Lett. 12(6): 065005. https://doi.org/10.1088/1748-9326/aa6f94
- Buotte, P.C., B.E. Law, W.J. Ripple, L.T. Berner. 2020. Carbon sequestration and biodiversity co-benefits of preserving forests in the western United States. Ecol Applic 30(2):e02039. 10.1002/eap.2039
- Buotte, P.C., S. Levis, B.E. Law, T.W. Hudiburg, D.E. Rupp, J.J. Kent. 2019. Near-future vulnerability to drought and fire varies across the western United States. Global Change Biology 25:290-303. Doi.org/10.1111/gcb.14490
- Campbell, J.L. et al. 2011. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? Front Ecol Env doi:10.1890/110057
- Davis, K.T. 2019. Microclimatic buffering in forests of the future: The role of local water balance. Ecography 42:1-11. doi: 10.1111/ecog.03836
- Frey, SJK et al. 2016. Spatial models reveal the microclimatic buffering capacity of old-growth forests. Sci. Adv. 2016; 2 : e1501392
- Hudiburg, T.W, B.E. Law, W.R. Moomaw, M.E. Harmon, J.E. Stenzel. 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. Env. Res. Lett. 14: 095005. https://iopscience.iop.org/article/10.1088/1748-9326/ab28bb
- Hudiburg, T.W., S. Luyssaert, P.E. Thornton, B.E. Law. 2013. Interactive effects of environmental change and management strategies on regional forest carbon emissions. Environmental Science & Technology 47(22):13132-40. Doi: 10.1021/es402903u
- Irvine, J., Law, B.E., Meinzer, F.R. 2002. Water limitations to carbon exchange in old-growth and young ponderosa pine stands. Tree Physiology 22:189-196.
- Jacobson, A.P. et al. 2019. Global areas of low human impact…. Nature Sci Rep *9:14179* https://doi.org/10.1038/s41598-019-50558-6
- Law, B.E., T.W. Hudiburg, L.T. Berner, J.J. Kent, P.C. Buotte, and M. Harmon. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proc. Nat. Acad. Sci. 115(14):3663-3668. https://doi.org/10.1073/pnas.1720064115
- Law, B.E., Law, B.E., P. Thornton, J. Irvine, P. Anthoni, S. Van Tuyl. 2001. Carbon storage and fluxes in ponderosa pine forests at different developmental stages. *Global Change Biology* 7:755-777.
- Moomaw, W.M. et al. 2019. Intact forests in the United States: Proforestation mitigates climate change and serves the greatest good. Frontiers in Forests & Global Change. doi: 10.3389/ffgc.2019.00027
- Vickers, D. et al. 2012. Five years of carbon fluxes and inherent water-use efficiency at two semi-arid pine forests with different disturbance histories. Tellus B 64, 17159, DOI: 10.3402/tellusb.v64i0.17159.
- Zhou, D. et al. 2013. A meta-analysis on the impacts of partial cutting on forest structure and carbon storage. Biogeosciences, 10, 3691–3703, 2013 www.biogeosciences.net/10/3691/2013/doi:10.5194/bg-10-3691-2013

Panel 2 – Questions & Answers

Dominick Della Sala
Geos Institute

Chad Hanson
John Muir Project

John Alexander
Klamath Bird Observatory

Bev Law
Oregon State University

Welcome Panel 3

James Johnston
Oregon State University

Andrés Holtz
Portland State University

Andrew Merschel
Oregon State University

James Johnston

Successional and disturbance dynamics on the Malheur National Forest

James Johnston

james.johnston@oregonstate.edu

Harley, G.L., E.K. Heyerdahl, J.D. Johnston, and D.L. Olson. 2020. Riparian and adjacent upland forests burned synchronously during dry years in eastern Oregon (1650-1900 CE), USA. International Journal of Wildland Fire.

Johnston, J.D., C.J. Dunn, M.J. Vernon, J.D. Bailey, B.A. Morrisette, and K. Morici. 2018. Restoring historical forest conditions in a diverse inland Pacific Northwest landscape. Ecosphere 9(8).

Johnston, J.D., J.D. Bailey, C.J. Dunn, and A.A. Lindsay. 2017. Historical fire-climate relationships in contrasting interior Pacific Northwest forest types. Fire Ecology 13(2).

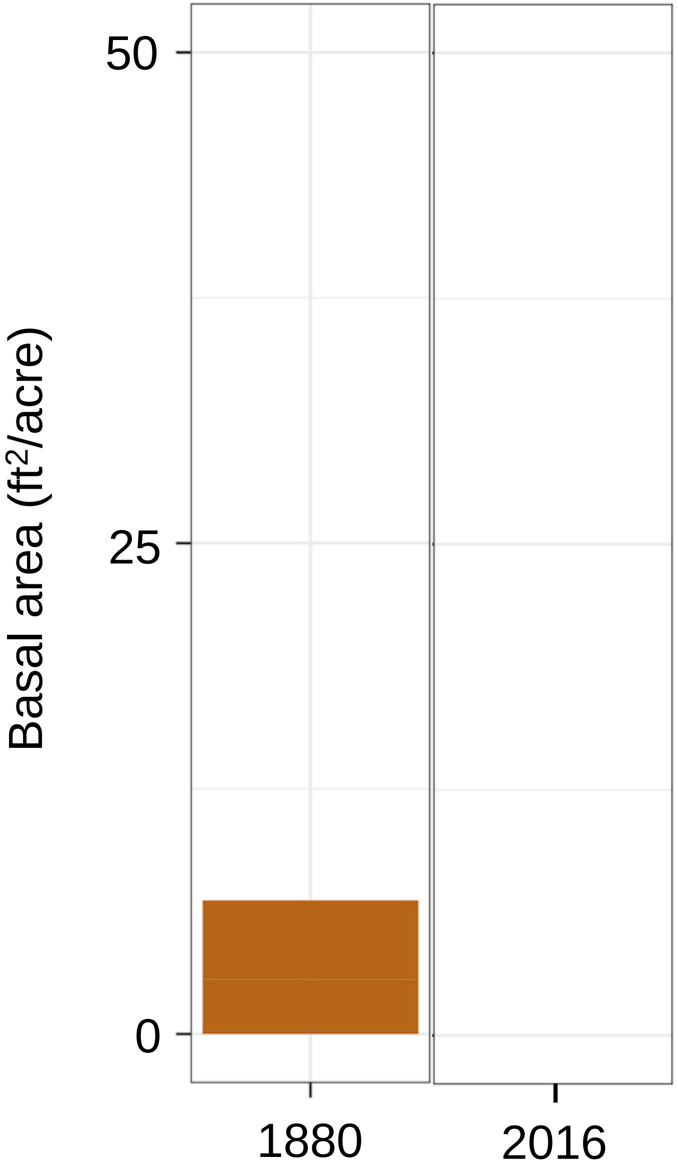
Johnston, J.D. 2017. Forest succession along a productivity gradient following fire exclusion. Forest Ecology and Management 392:45-57.

Johnston, J.D., J.D. Bailey, and C.J. Dunn. 2016. Influence of fire disturbance and biophysical heterogeneity on pre-settlement ponderosa pine and mixed conifer forests. Ecosphere 7(11).

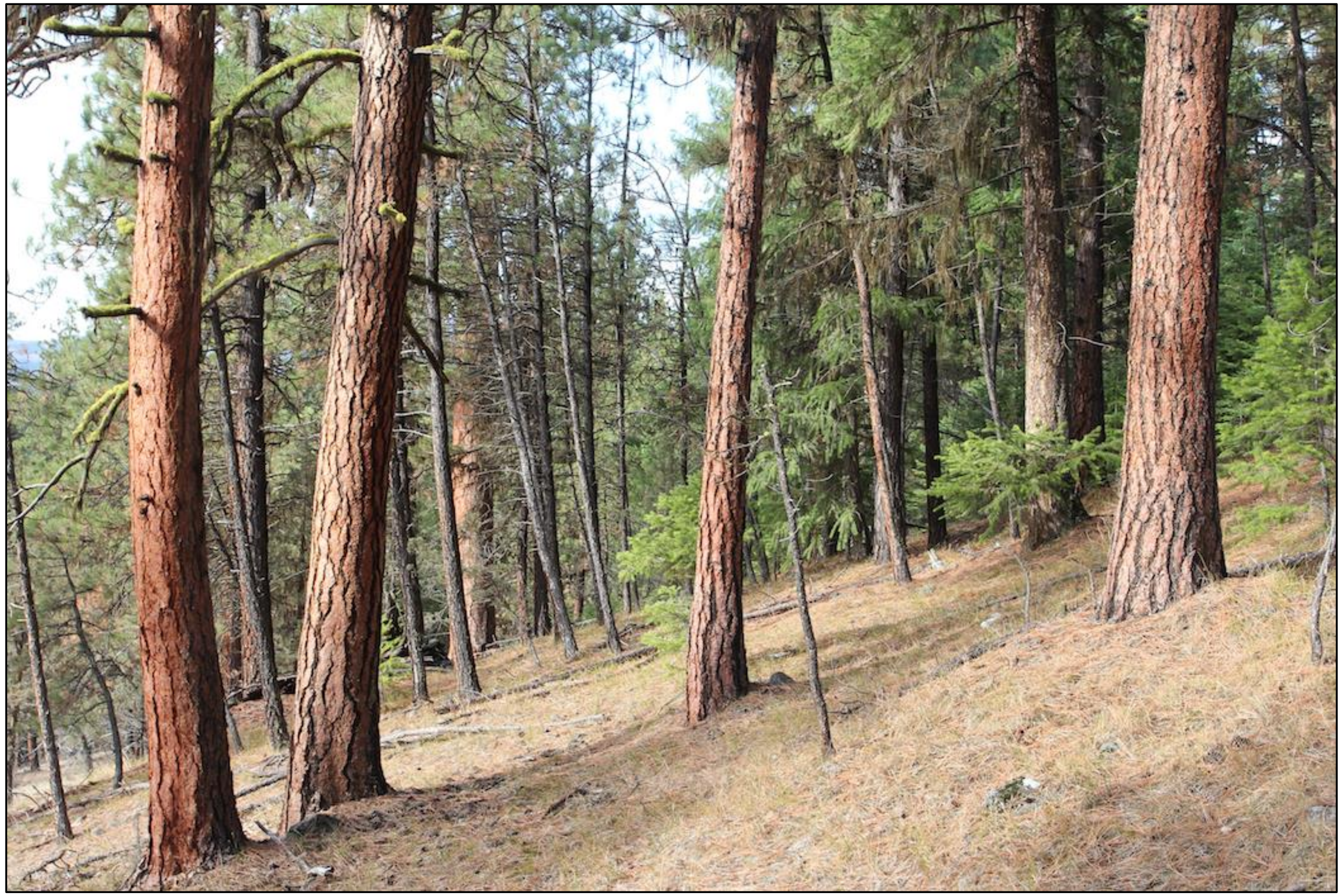
There is little evidence of a shortage of >21” trees relative to historical conditions.

Historical forest reconstructions (21”): Pine 1

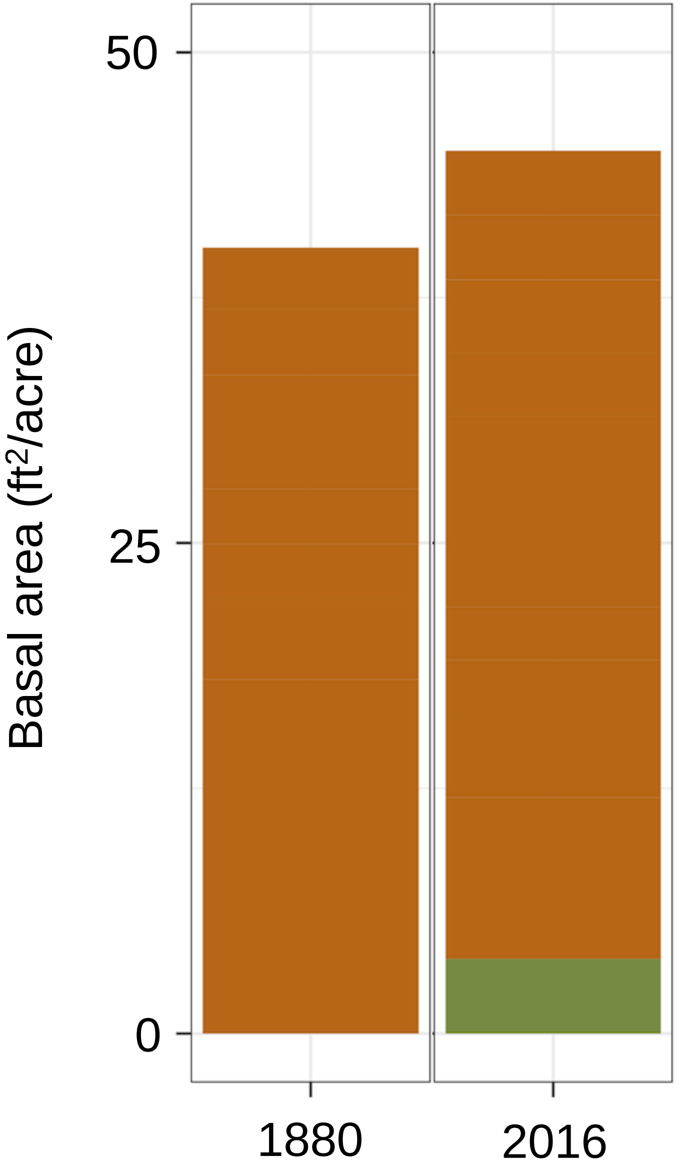
Ponderosa | Grand fir | Spruce
Juniper | Larch | Lodgepole
Douglas-fir | White pine



Historical forest reconstructions (21”): Pine 2

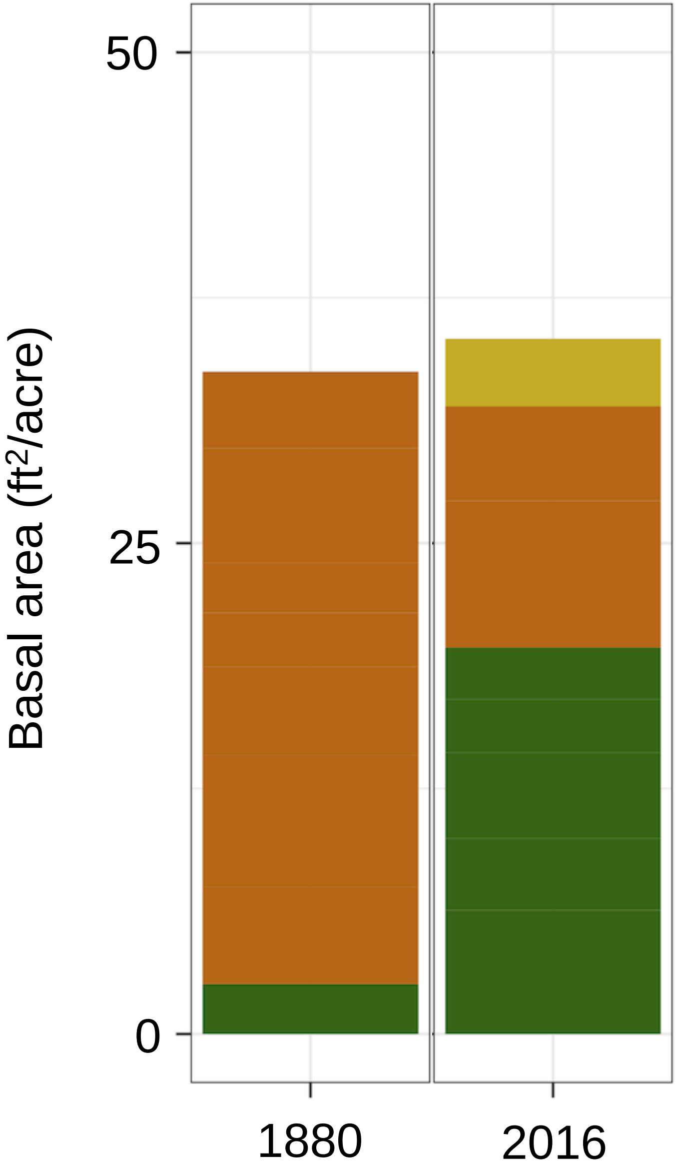


Ponderosa
Juniper
Douglas-fir
Grand fir
Larch
White pine
Spruce
Lodgepole

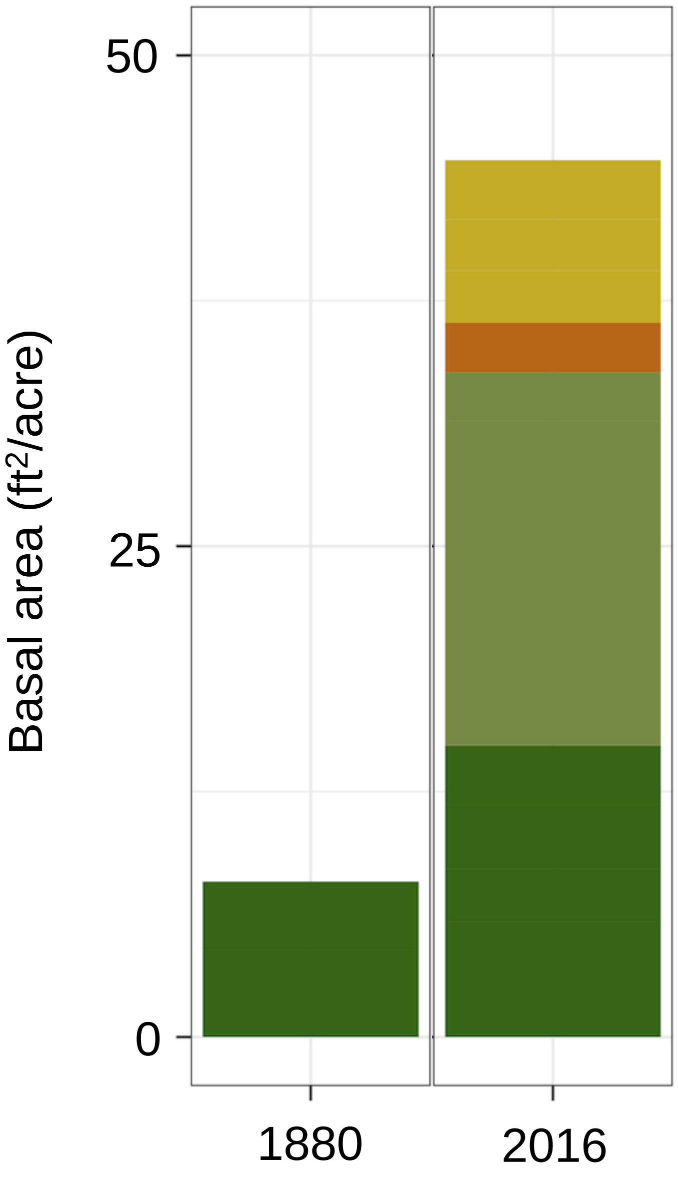


Historical forest reconstructions (21"): Mixed con. 1

Ponderosa
Juniper
Douglas-fir
Grand fir
Larch
White pine
Spruce
Lodgepole



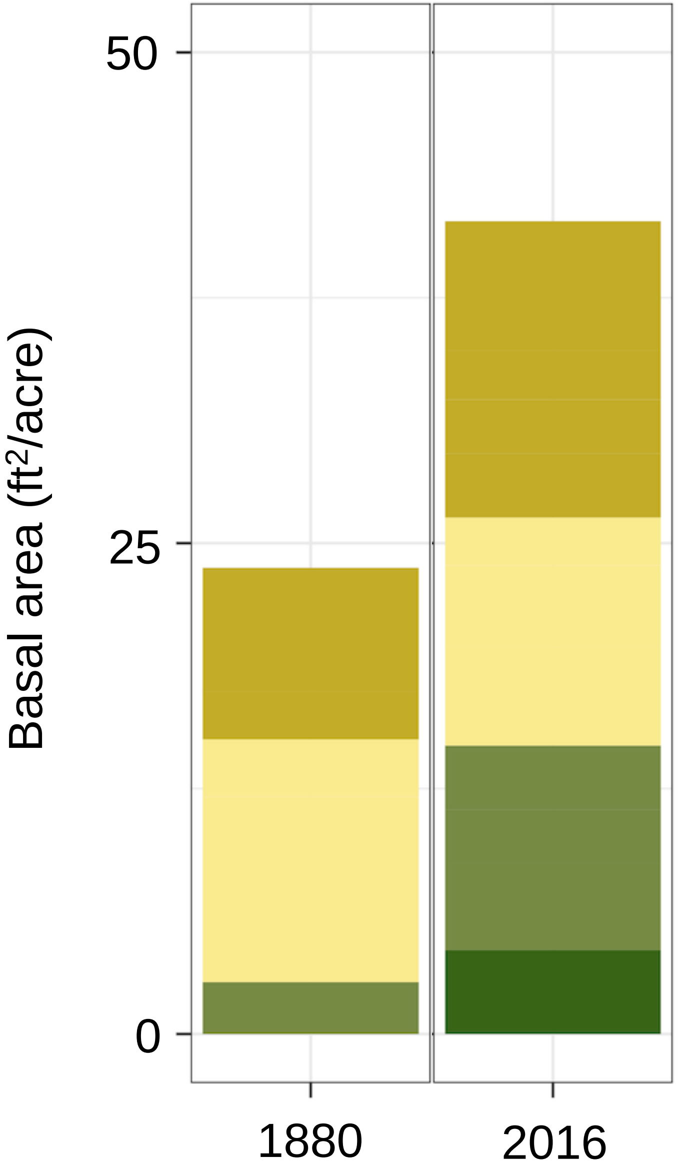
Historical forest reconstructions (21"): Mixed con. 2



Ponderosa
Juniper
Douglas-fir
Grand fir
Larch
White pine
Spruce
Lodgepole

Historical forest reconstructions (21”): Mixed con. 3

Ponderosa | Grand fir | Spruce
Juniper | Larch | Lodgepole
Douglas-fir | White pine



There is little evidence of a shortage of >21” trees relative to historical conditions.

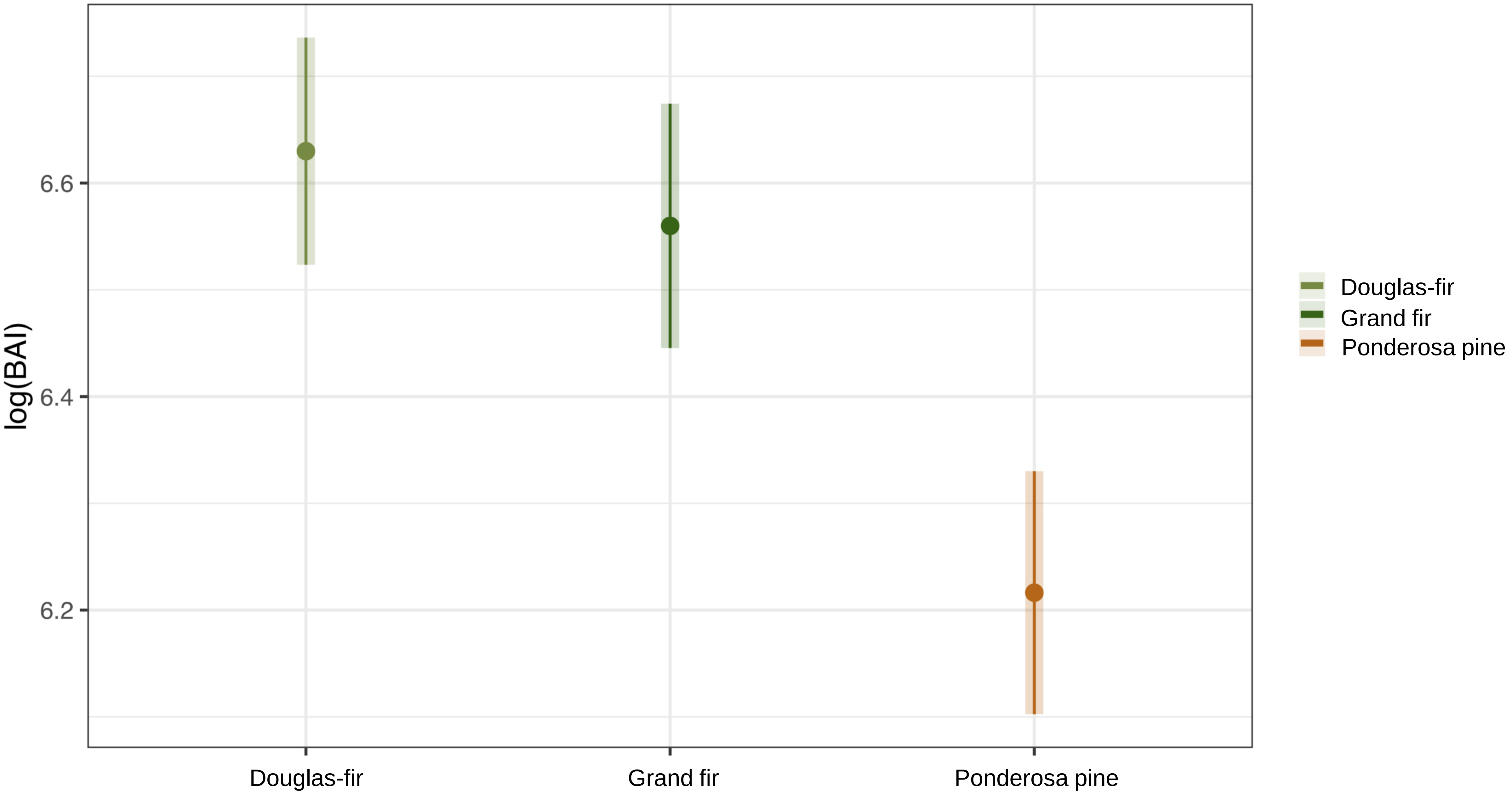
But it doesn’t really matter. What matters is the future. Future dynamics are a function of disturbance and succession.

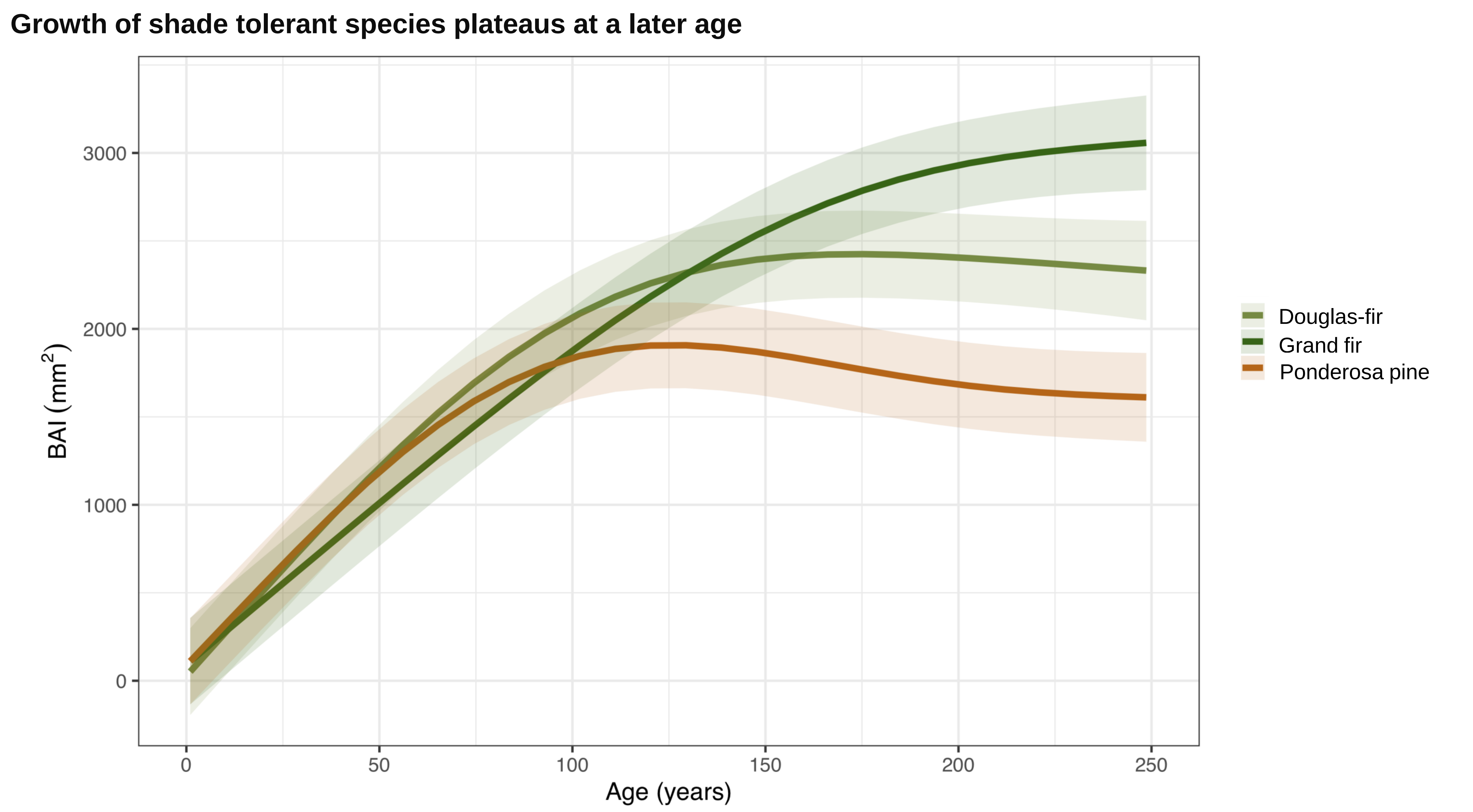
If mixed conifer stands are not disturbed, they will be totally taken over by shade tolerant species: grand fir and Douglas-fir.

For three reasons:

There is little or no shade intolerant regeneration in mixed conifer stands

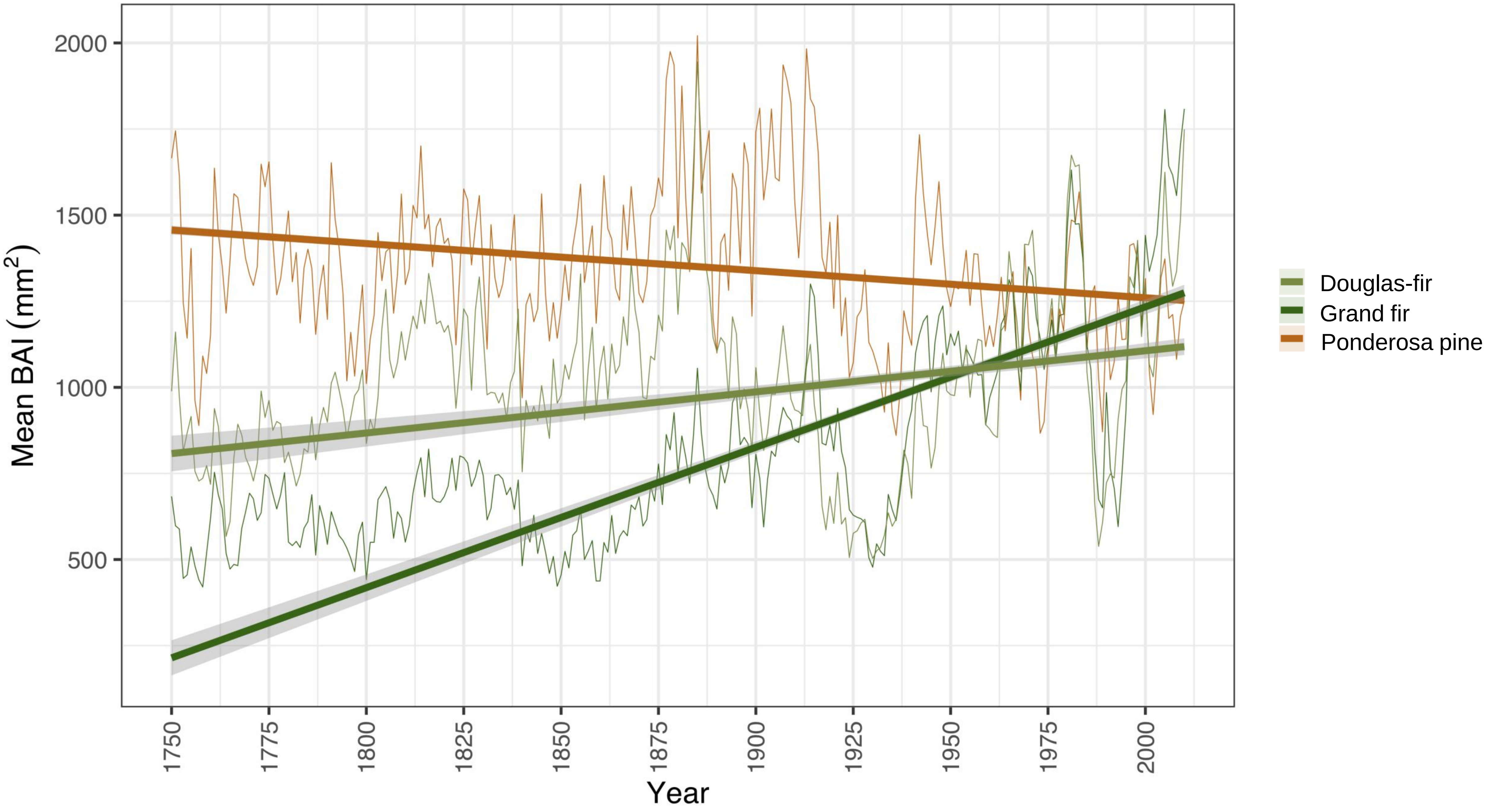
Shade tolerant species grow a lot faster than shade intolerant species





Growth of shade tolerant species plateaus at a later age
BAI (mm²)
3000
2000
1000
0
0
50
100
150
200
250
Age (years)
Douglas-fir
Grand fir
Ponderosa pine

Stand trajectories



Can we use fire to remove shade tolerant species?

Can we use fire to remove shade tolerant species?

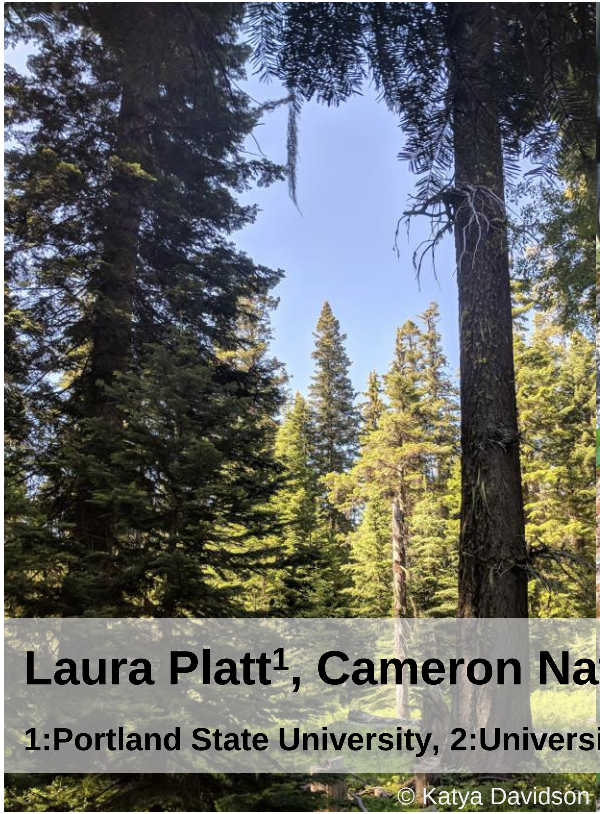
Can we use fire to remove shade tolerant species?

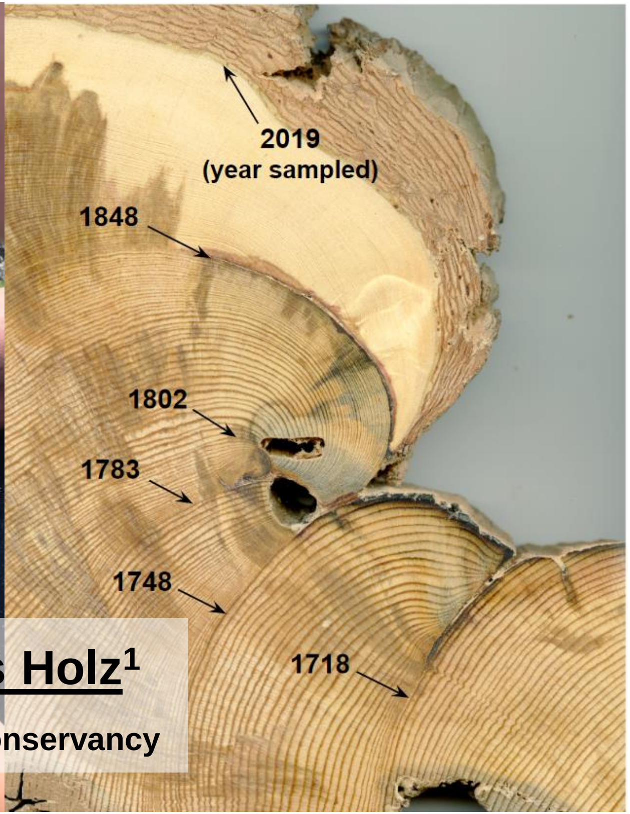
It’s all about goals. What do we want?

Do we want, and can we sustain, stands that are taken over by shade tolerant species?

If so, we are in great shape.
We don’t need to do anything differently.

Variability in historical fire patterns of a moist mixed-conifer forest in northeastern Oregon: **preliminary results**

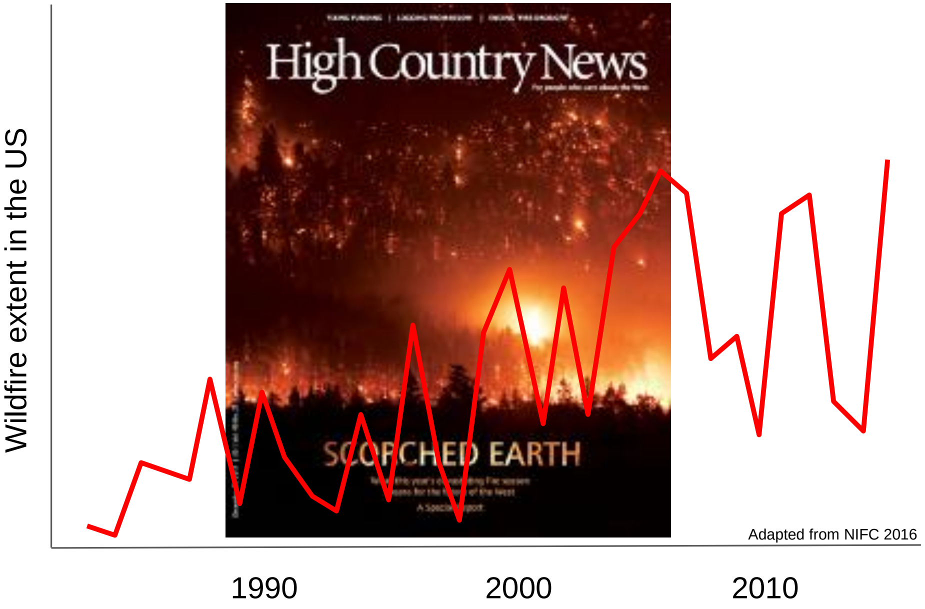




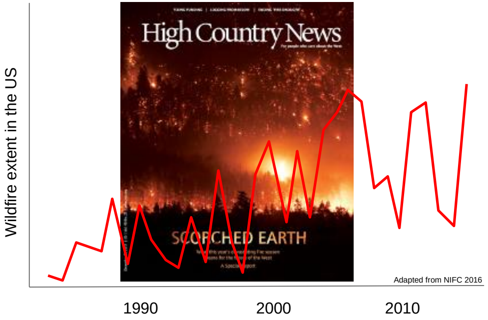
Laura Platt[1], Cameron Naficy[2], Kerry Kemp[3], Andrés Holz[1]

1:Portland State University, 2:University of British Columbia, 3:The Nature Conservancy

Fire, past and present

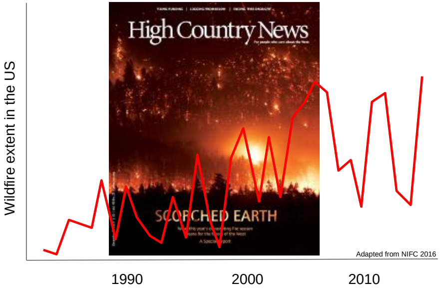


Fire, past and present



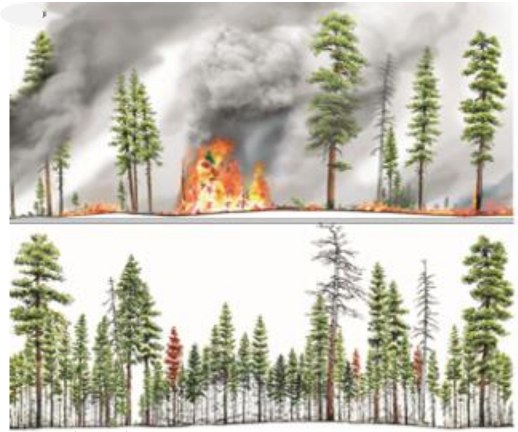
Over a century of fuel/fire management

Fire, past and present



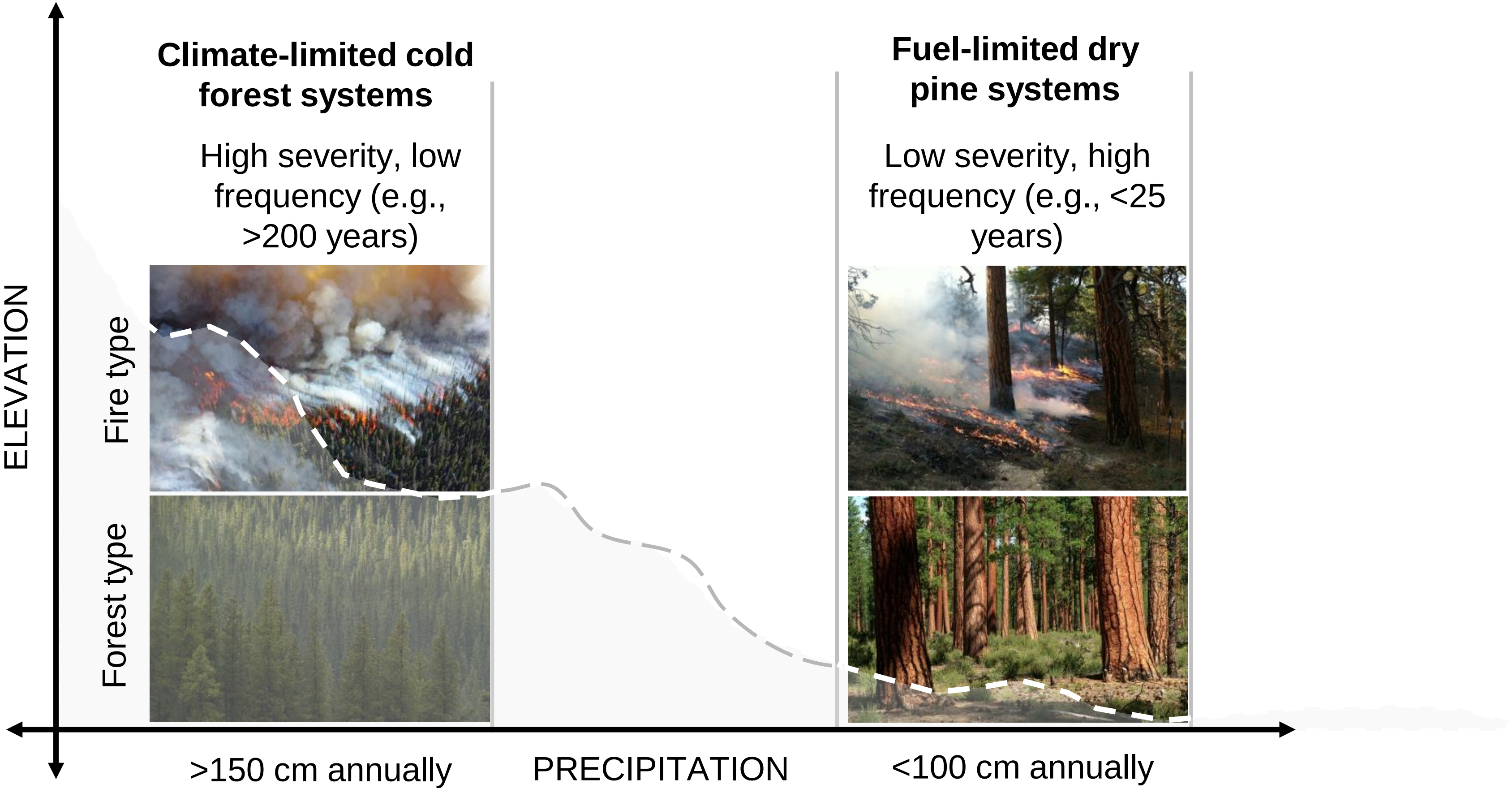
Over a century of fuel/fire management

Dramatic changes in forest structure



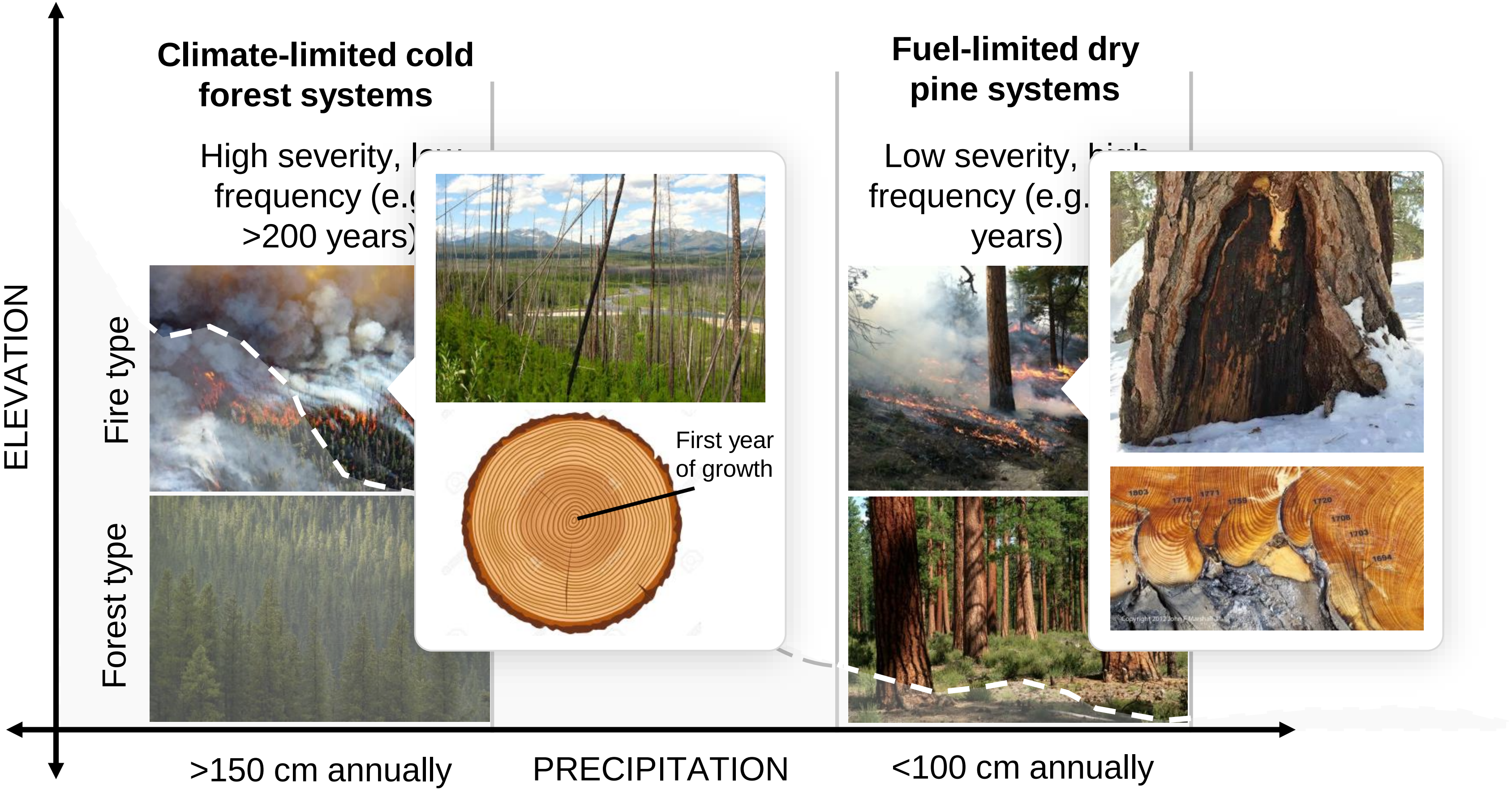
From Hessburg et al 2019

Two dominant paradigms of fire patterns...



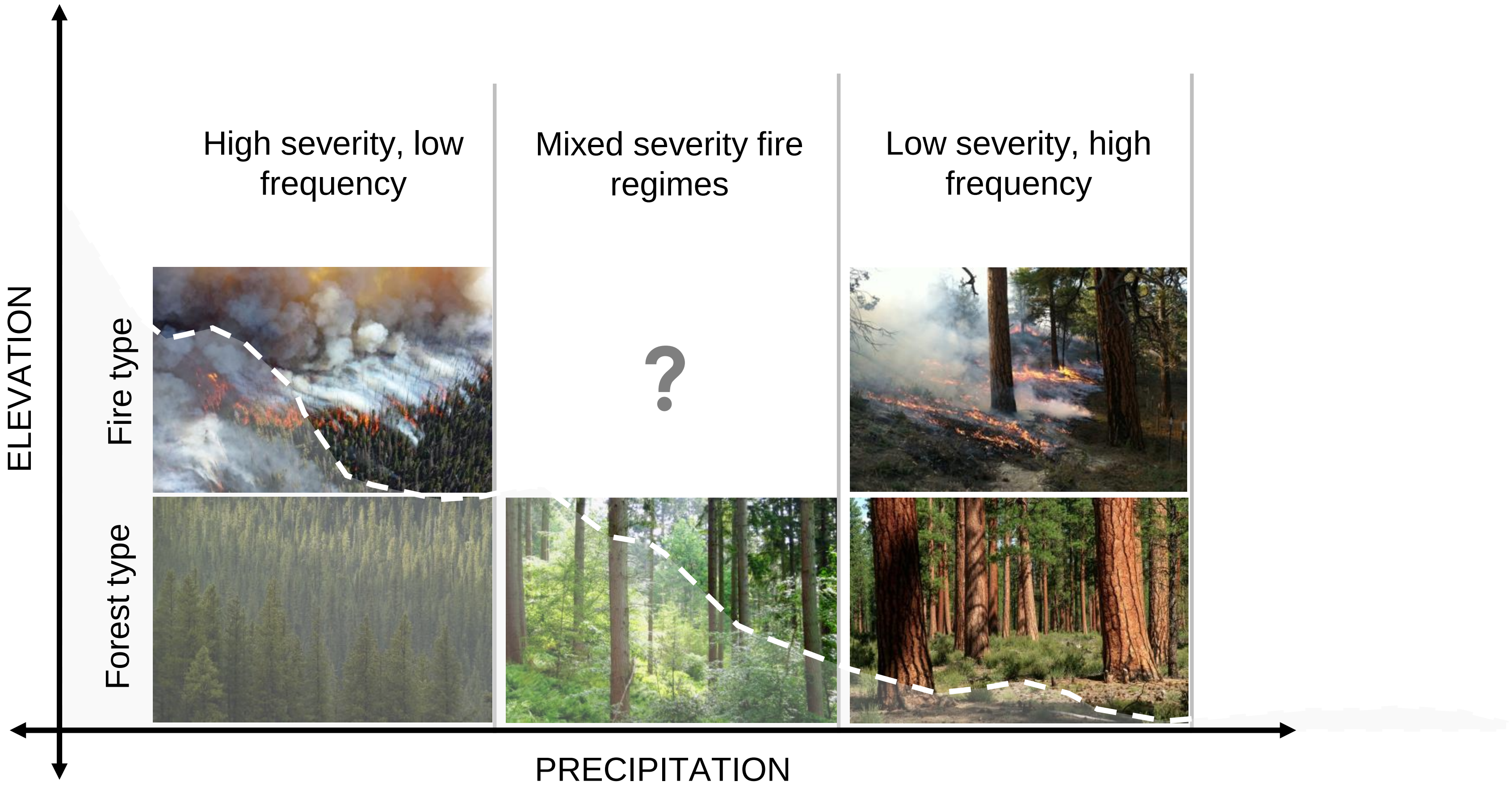
Slide adapted from K. Kemp April 2020 PNWRS EOU Lab Group presentation; Stine et al. 2014

…reconstructed from dendroecological evidence.



Slide adapted from K. Kemp April 2020 PNWRS EOU Lab Group presentation

But what about the forests in between?



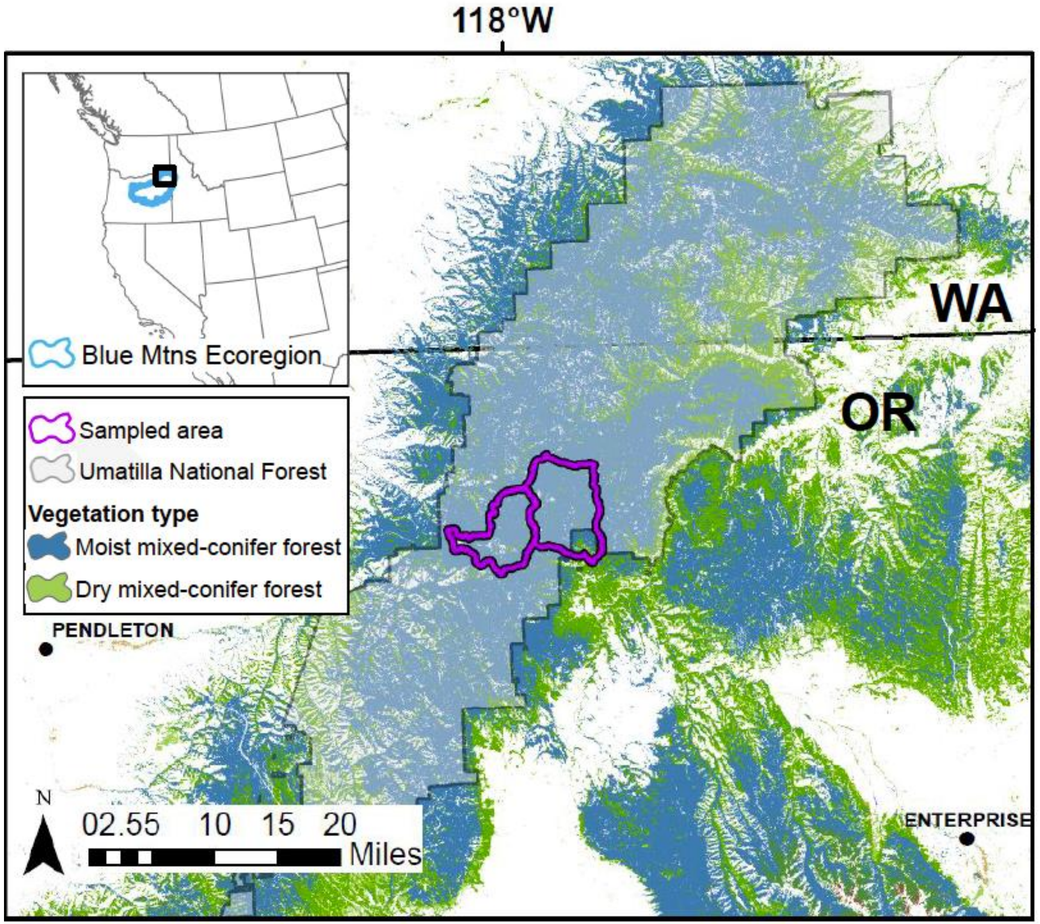
Slide adapted from K. Kemp April 2020 PNWRS EOU Lab Group presentation

Research questions

Objective:
Characterize the variability in historical fire patterns and tree establishment in a mid-elevation moist mixed-conifer forest in NE Oregon

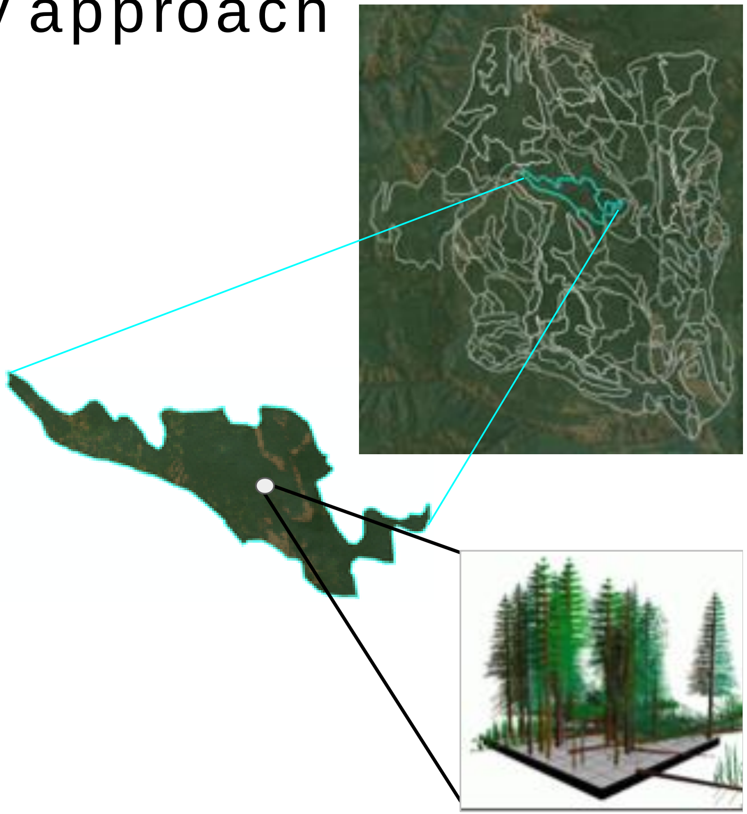
1. What were the fire patterns (occurrence and frequency) in this forest over the past couple centuries?
2. What were the patterns in tree establishment, and how did they relate to historical drought conditions and fire events?
3. How did historical fire patterns (frequency and severity) vary among forest patches in the study area?

Study area


118°W
WA
OR
Blue Mtns Ecoregion
Sampled area
Umatilla National Forest
Vegetation type
Moist mixed-conifer forest
Dry mixed-conifer forest
PENDLETON
ENTERPRISE
N
0 2.5 5 10 15 20
Miles

Hierarchical, multi-proxy approach

- **Subwatersheds**
  - meso-scale biophysical gradients
  - sampling stratification
- **Patches (aka forest stands)**
  - historic aerial photography
  - spatial and structural variability
- **Plots**
  - dendroecological samples
  - fire-mediated pattern-process linkages
    - age structure
    - fire frequency & severity



Slide adapted from C. Naficy, 2019 NW Fire Science consortium webinar

Hierarchical, multi-proxy approach

- **Subwatersheds**
  - meso-scale biophysical gradients
  - sampling stratification
- **Patches (aka forest stands)**
  - historic aerial photography
  - spatial and structural variability
- **Plots**
  - dendroecological samples
  - fire-mediated pattern-process linkages
    - age structure
    - fire frequency & severity

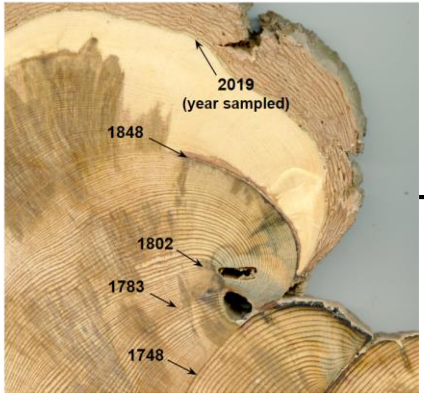
Slide adapted from C. Naficy, 2019 NW Fire Science consortium webinar

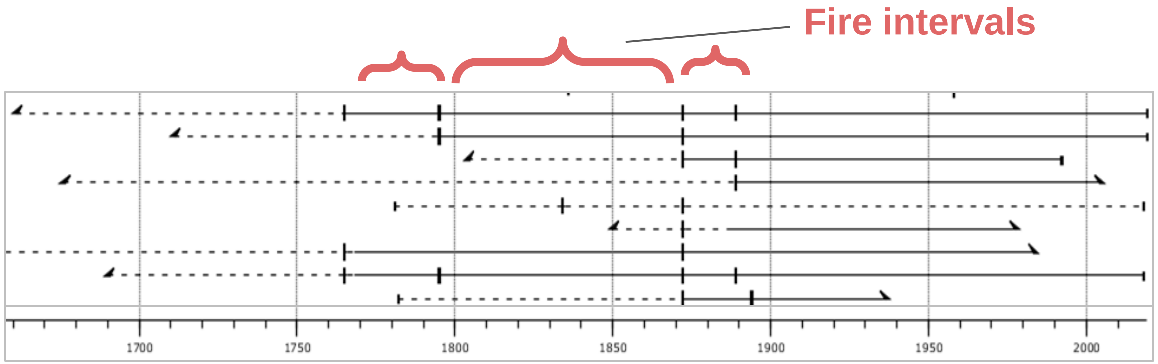
Dendroecological data collection

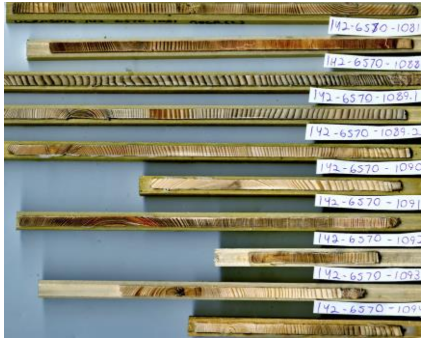
Fire scar samples:
Fire dates and frequency

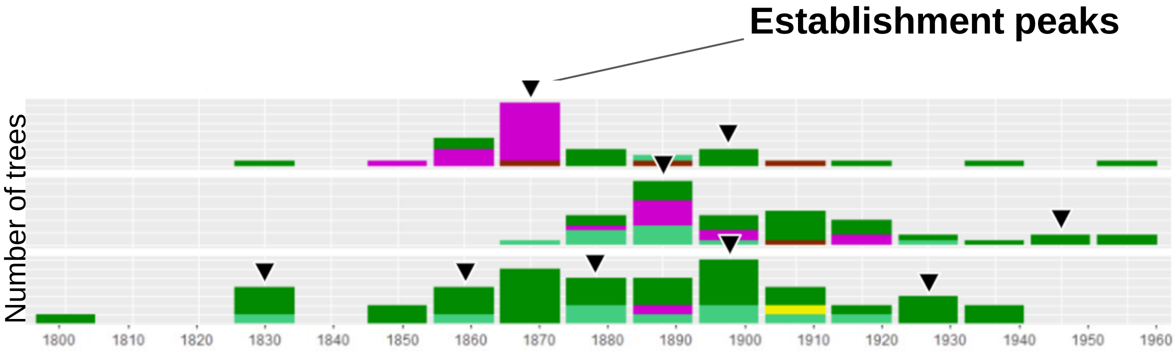
Tree cores:
Tree establishment dates
Fire severity

Processing and Analysis



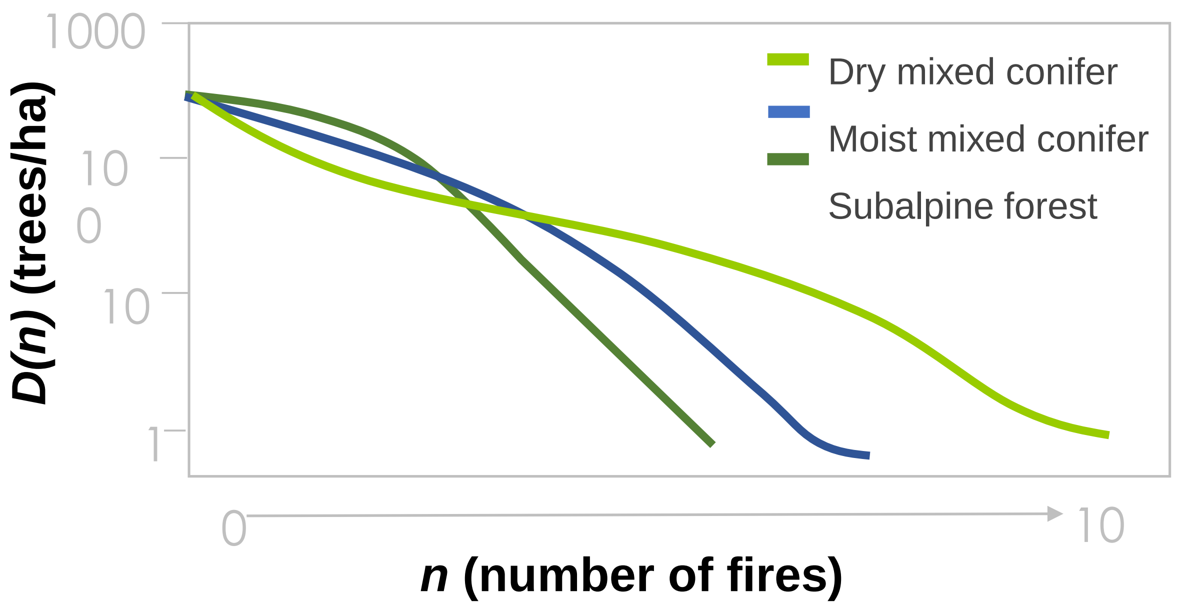






Deriving historical fire severity

- Age structure data (tree density) and fire record
- Assumes decline in tree density with each sequential fire

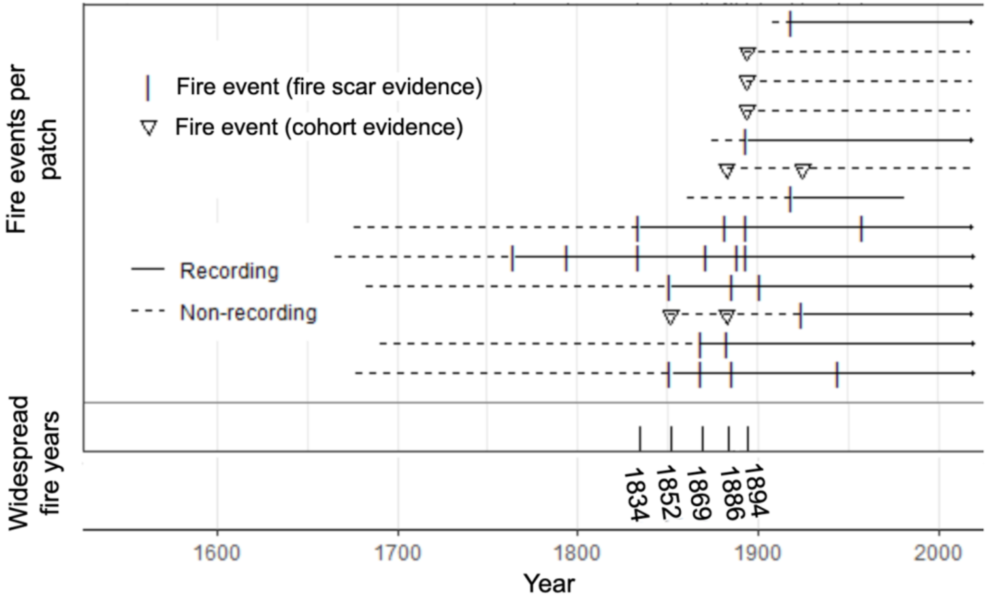


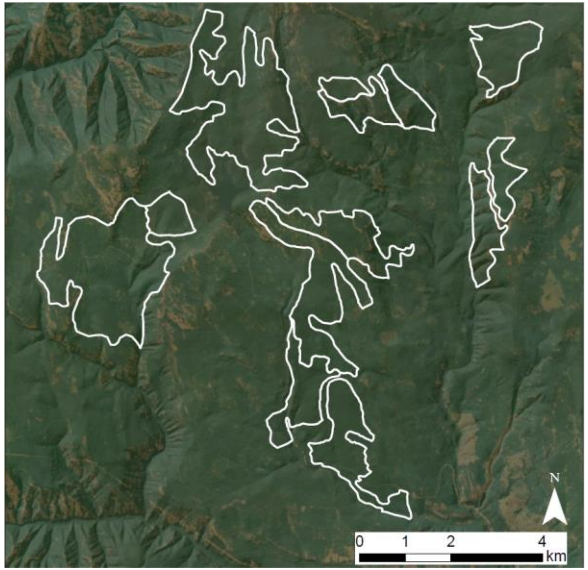
Adapted from Tepley and Veblen 2015

Preliminary Results

Research question 1: historical fire frequency

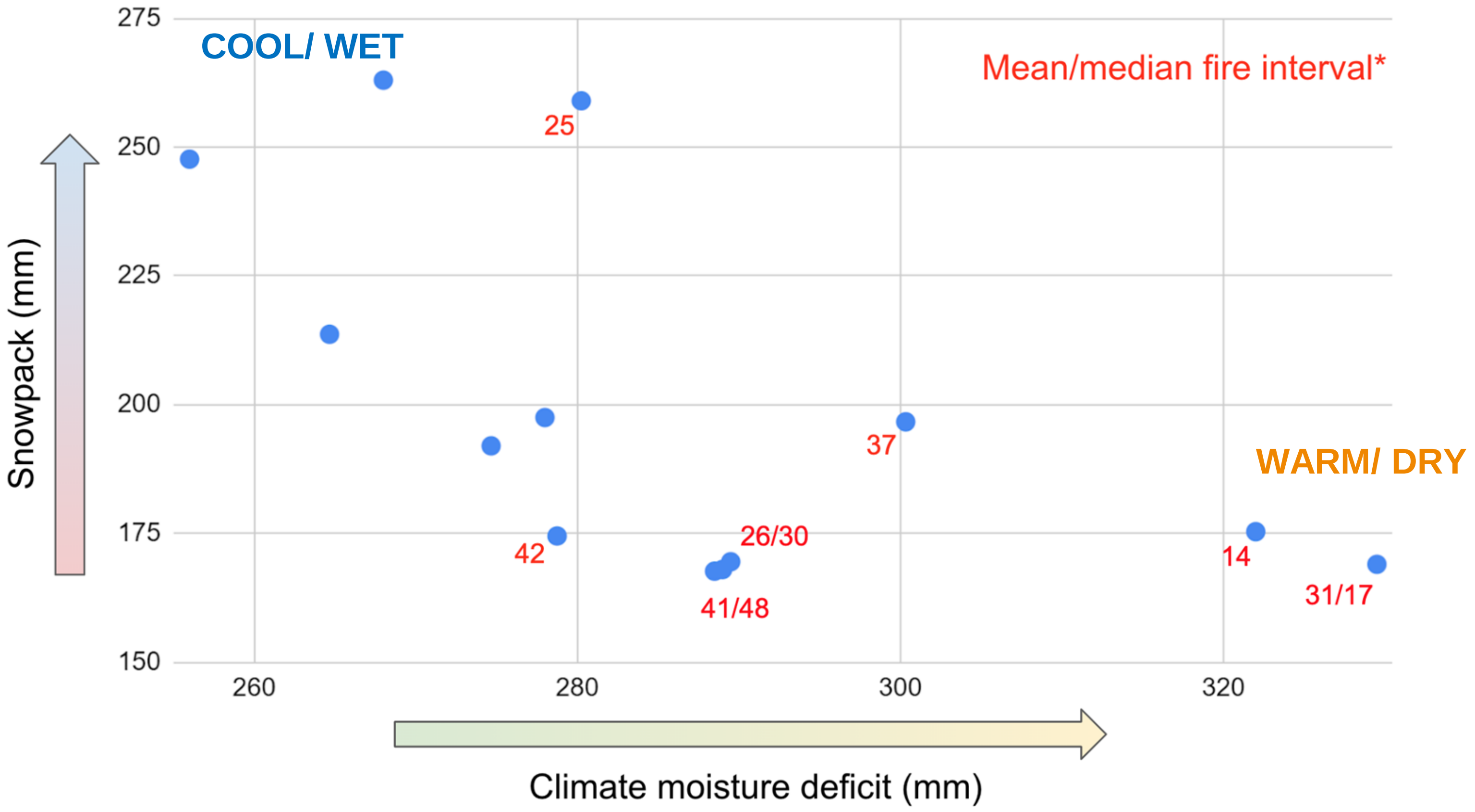
- Relatively frequent fire
  - Mean interval 14-42 yrs.
- No widespread fires (in this unburned watershed) after 1894





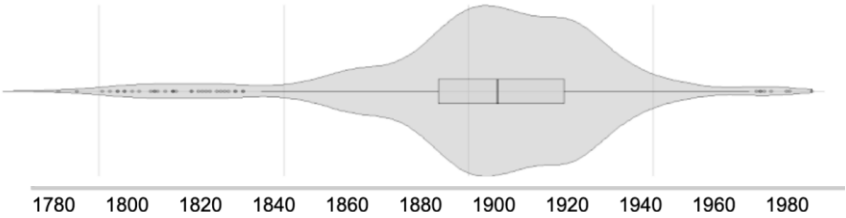
Preliminary Results

Research question 1: historical fire frequency



Preliminary Results

Research question 2: tree establishment patterns



- Tree establishment concentrated between 1880-1930

Preliminary Results

Research question 2 : tree establishment patterns, fire & climate

- Tree establishment concentrated between 1880-1930

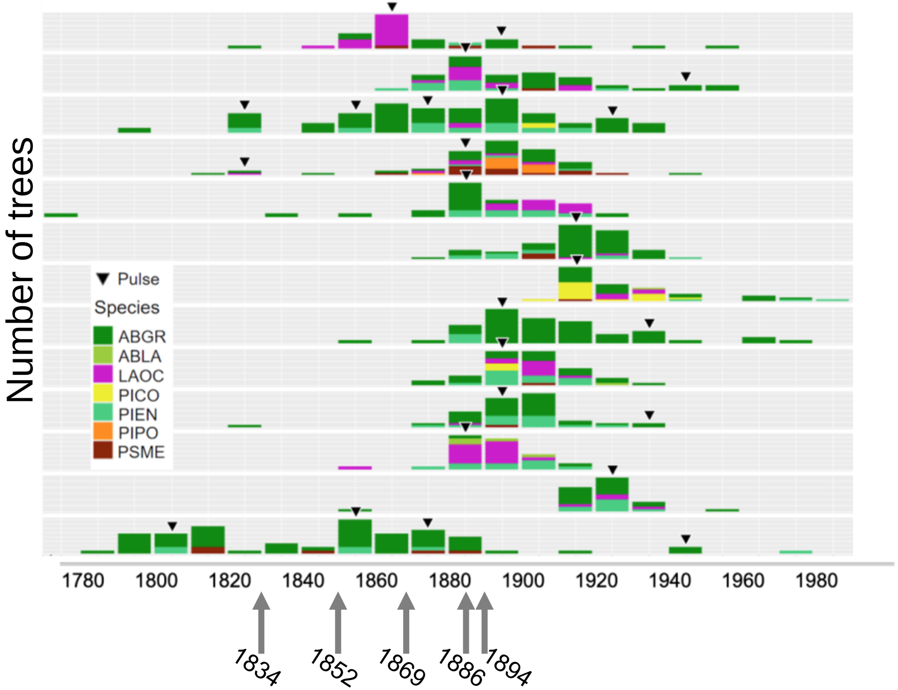
- Establishment dominated by grand fir

Preliminary Results

Research question 2 : tree establishment patterns, fire & climate

- Tree establishment concentrated between 1880-1930
- Establishment dominated by grand fir
- Widespread Fire Years

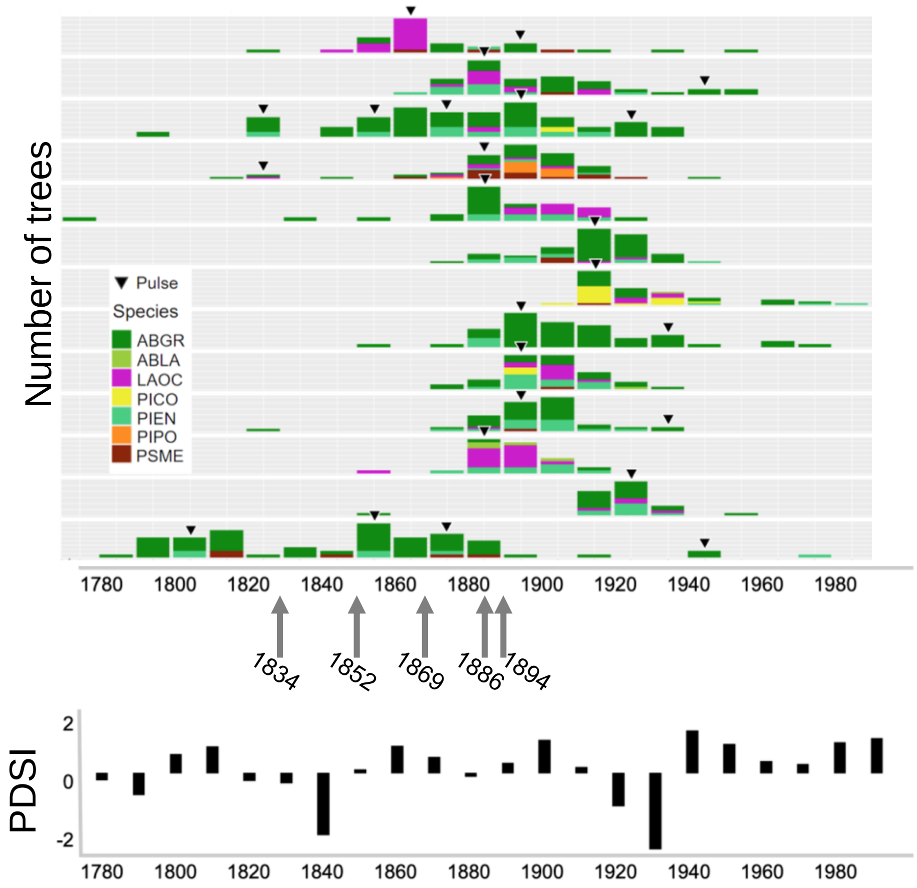
(>30% of all fire recording trees & min 2 patches recording fire)



Preliminary Results

Research question 2 : tree establishment patterns, fire & climate

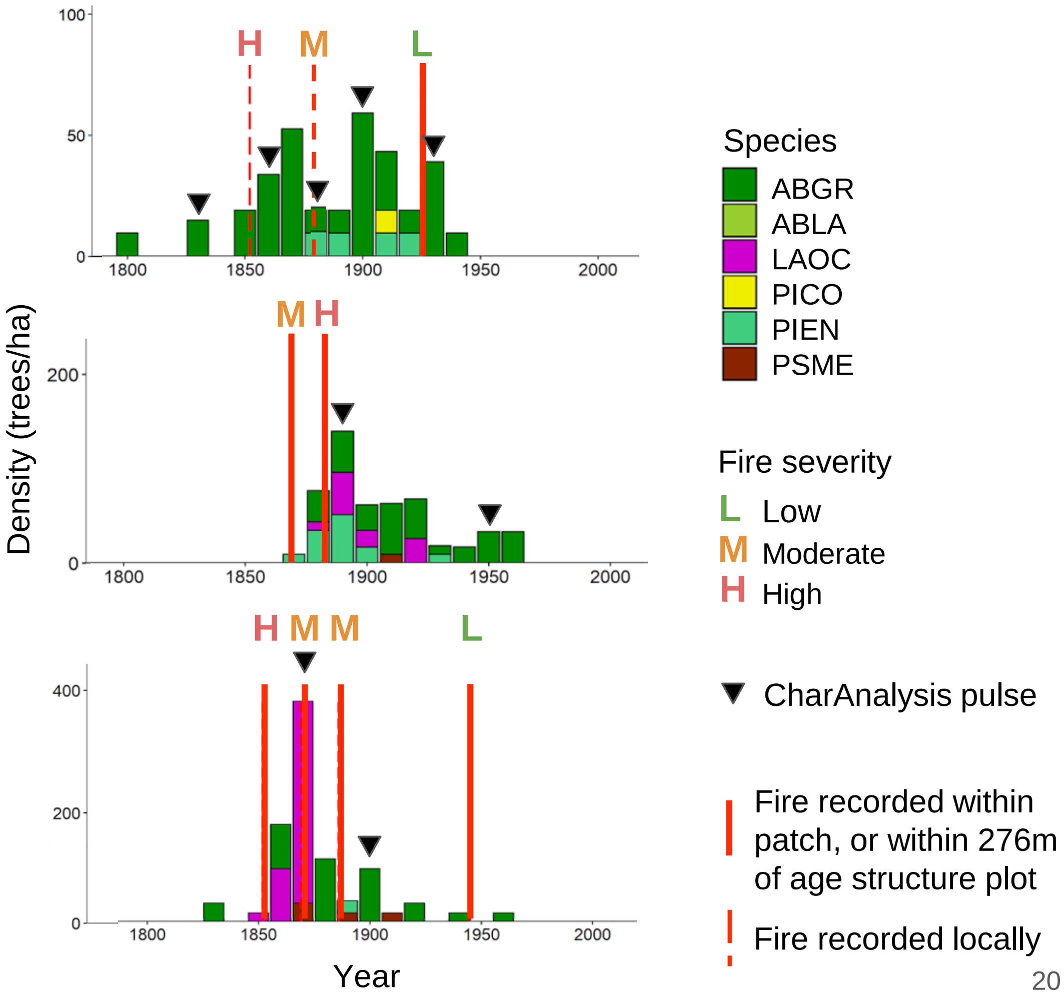
- Tree establishment concentrated between 1880-1930
- Establishment dominated by grand fir
- Widespread Fire Years ↑
  (>30% of all fire recording trees & min 2 patches recording fire)
- Establishment peaks/ fire events not associated (at least visually) with anomalously wet or dry 10-yr periods



Preliminary Results

Research questions 2 and 3: tree establishment and fire severity patterns

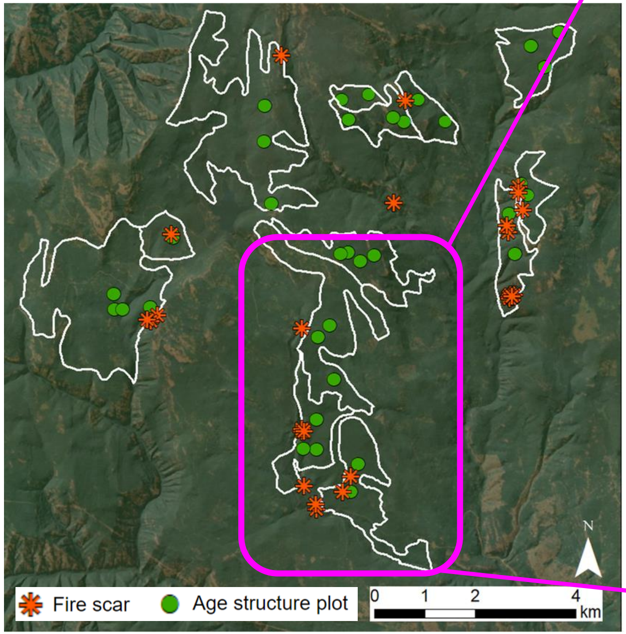
- Tree establishment closely related to fire
- Post-fire cohorts of grand fir
- Mix of fire severities over time

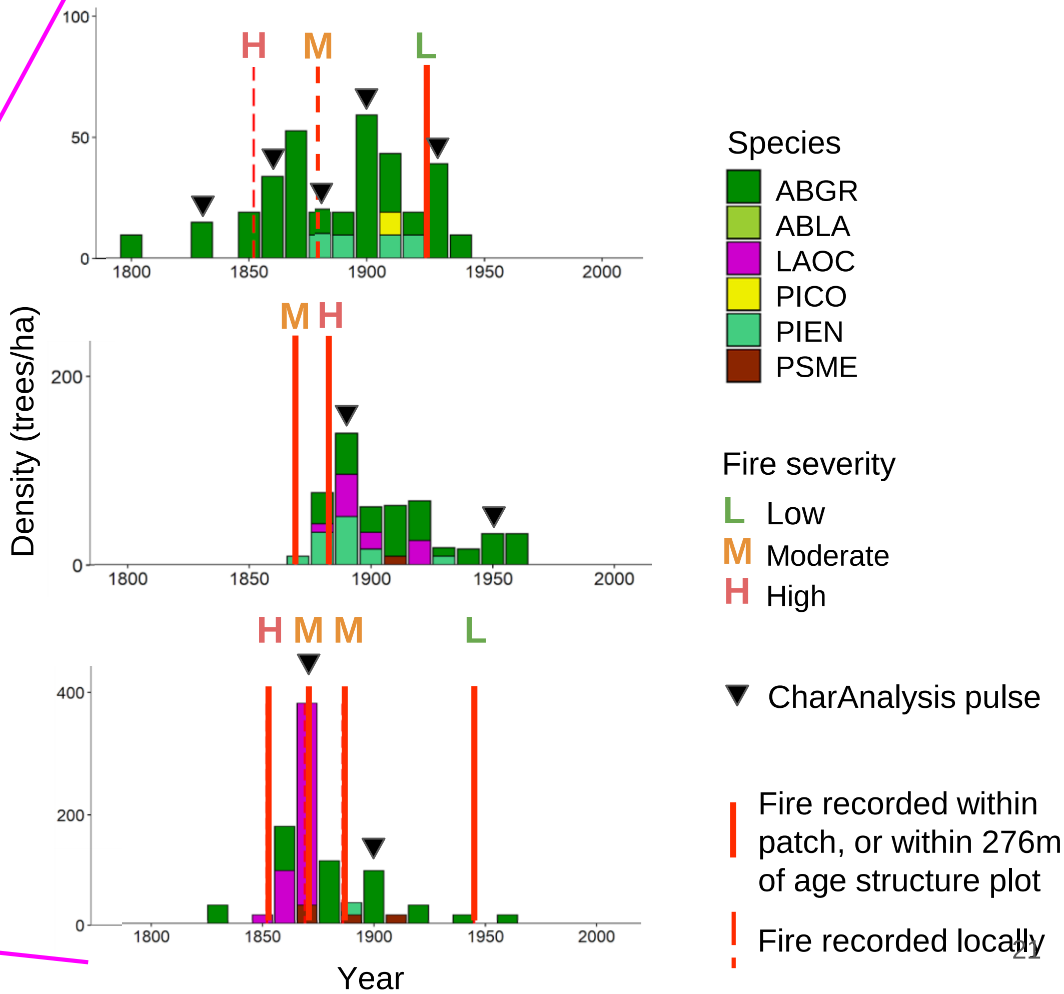


Preliminary Results

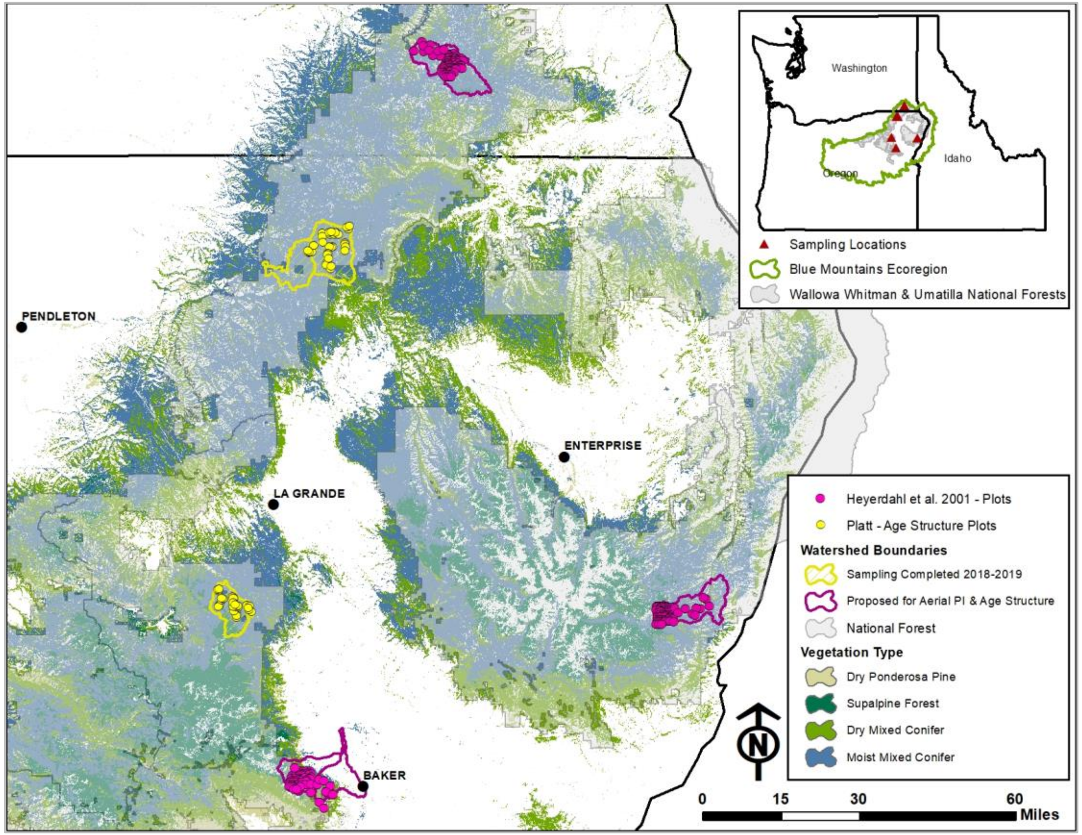
Research questions 2 and 3: tree establishment and fire severity patterns

- Fine-scale variability



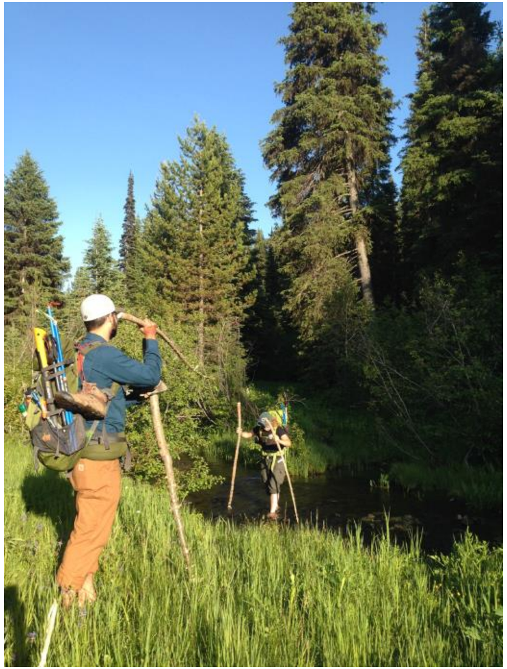


These preliminary results part of larger ongoing effort



Slide adapted from K. Kemp April 2020 PNWRS EOU Lab Group presentation

Thank you for your time!



Funding:

Partners:

Acknowledgements:

Laura Platt, Cameron Naficy, Kerry Kemp, USFS partners, Jen Litteral, Josefa Ovalle, Joel Riggs, Katya Davidson, Paul Lask, Desiree Monarrez, Sebastian Singleton, Alex Fager, Maddie Collins, Jeff Smith, Kayla Johnston, Devin Wilde, Anthony Holmes, Sebastian Busby, and Geoff Thorpe

These **references** describe both historical conditions and dynamics and changes in these associated with logging, fire exclusion, and grazing since the late 19th century. The scope of inference is dry forests that historically had a frequent low-severity fire regime in the East Cascades, Ochoco Mountains, and southern Blue Mountains in Oregon

Hagmann, R. K., Franklin, J. F., & Johnson, K. N. (2013). Historical structure and composition of ponderosa pine and mixed-conifer forests in south-central Oregon. Forest Ecology and Management, 304, 492–504. https://doi.org/10.1016/j.foreco.2013.04.005

Hagmann, R. K., Franklin, J. F., & Johnson, K. N. (2014). Historical conditions in mixed-conifer forests on the eastern slopes of the northern Oregon cascade range, USA. Forest Ecology and Management, 330, 158–170. https://doi.org/10.1016/j.foreco.2014.06.044

Hagmann, R. K., Merschel, A.G., & Reilly M. J. (2019). Historical patterns of fire severity and forest structure and composition in a landscape structured by frequent large fires: Pumice Plateau ecoregion, Oregon, USA. Landscape Ecology, 34, 551-568. https://doi.org/10.1007/s10980-019-00791-1

Hessburg, P. F., Agee, J. K., & Franklin, J. F. (2005). Dry forests and wildland fires of the inland Northwest USA: Contrasting the landscape ecology of the pre-settlement and modern eras. Forest Ecology and Management, 211(1–2), 117–139. https://doi.org/10.1016/j.foreco.2005.02.016

Heyerdahl, E. K., Brubaker, L. B., & Agee, J. K. (2001). Spatial controls of historical fire regimes: A multiscale example from the interior west, USA. Ecology, 82(3), 660–678. https://doi.org/10.1890/0012-9658(2001)082[0660:SCOHFR]2.0.CO;2

Heyerdahl, E. K., Loehman, R. A., Falk, D. A. 2018. A multi-century history of fire regimes along a transect of mixed-conifer forests in central Oregon, USA. Canadian Journal of Forest Research.

Johnston, J. D., Bailey, J. D., & Dunn, C. J. (2016). Influence of fire disturbance and biophysical heterogeneity on pre-settlement ponderosa pine and mixed-conifer forests. *Ecosphere*, *7*(11), 1–19. https://doi.org/10.1002/ecs2.1581

Johnston, J. D. (2017). Forest succession along a productivity gradient following fire exclusion. *Forest Ecology and Management*, *392*, 45–57. https://doi.org/10.1016/j.foreco.2017.02.050

Johnston, J. D., Dunn, C. J., Vernon, M. J., Bailey, J. D., Morrissette, B. A., & Morici, K. E. (2018). Restoring historical forest conditions in a diverse inland Pacific Northwest landscape. *Ecosphere*, *9*(8). https://doi.org/10.1002/ecs2.2400

Johnston, J. D., Bailey, J. D., Dunn, C. J., & Lindsay, A. A. (2017). Historical fire–climate relationships in contrasting interior pacific northwest forest types. *Fire Ecology*, *13*(2), 18–36. https://doi.org/10.4996/fireecology.130257453

Merschel, A. G., Spies, T. A., & Heyerdahl, E. K. (2014). Mixed-conifer forests of central Oregon: Effects of logging and fire exclusion vary with environment. Ecological Applications, 24(7). https://doi.org/10.1890/13-1585.1

Merschel, A. G., Heyerdahl, E. K., Spies, T. A., & Loehman, R. A. (2018). Influence of landscape structure, topography, and forest type on spatial variation in historical fire regimes, Central Oregon, USA. Landscape Ecology, 33(7). https://doi.org/10.1007/s10980-018-0656-6

Merschel, A.G., Vora R.S. and Spies, T.A. 2019. Conserving Dry Old-Growth Forest in Central Oregon, USA. Journal of Forestry, Volume 117, 2, Pages 128-135. https://doi.org/10.1093/jofore/fvy085.

Stine P, Hessburg P, Spies T et al (2014). The Ecology of Moist Mixed-conifer Forests in Eastern Oregon and Washington: a Synthesis of the Relevant Biophysical Science and Implications for Future Land Management. PNW-GTR-897. USDA Forest Service, Portland, Oregon, USA. 254 p.

Youngblood, A., Max, T., & Coe, K. (2004). Stand structure in eastside old-growth ponderosa pine forests of Oregon and northern California. Forest Ecology and Management, 199(2–3), 191–217. https://doi.org/10.1016/j.foreco.2004.05.056

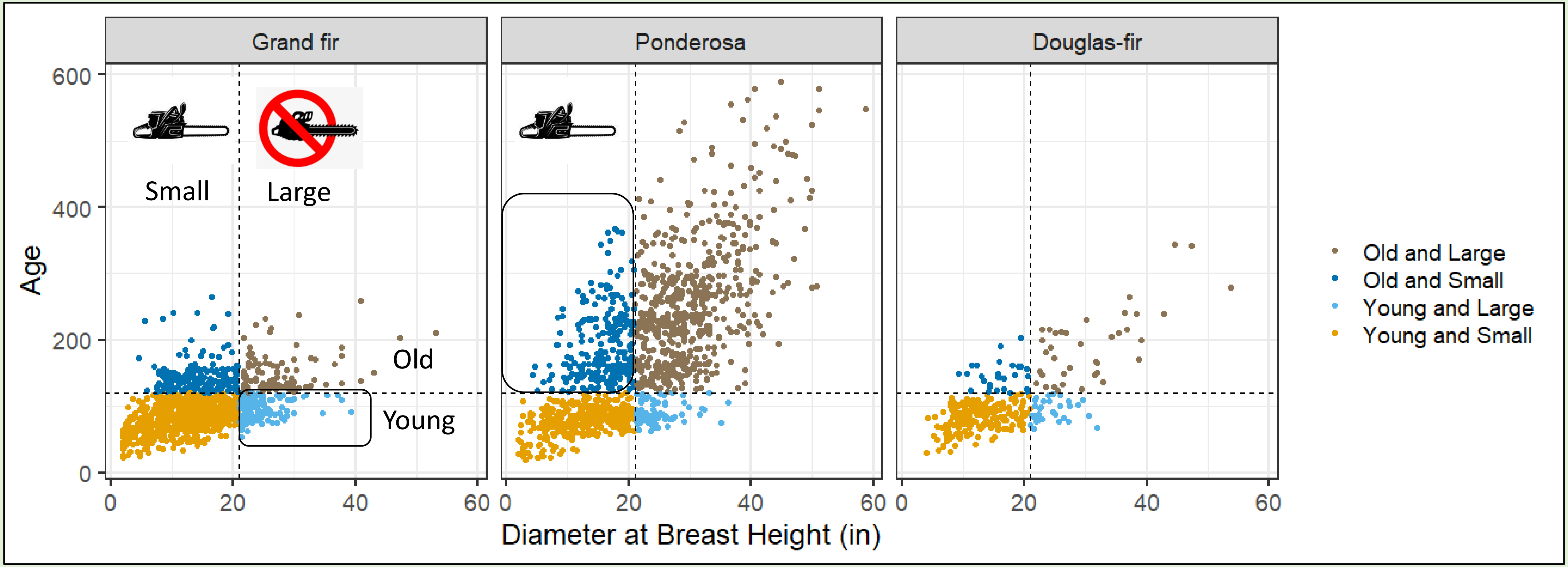
Historical Conditions and Dynamics in Dry Forests with Frequent Fire and the 21” Rule

Weaver 1931, PAO 43, Box 1204, NARA Seattle

Hagmann 2017

Andrew Merschel, Oregon State University
Andrew.Merschel@oregonstate.edu

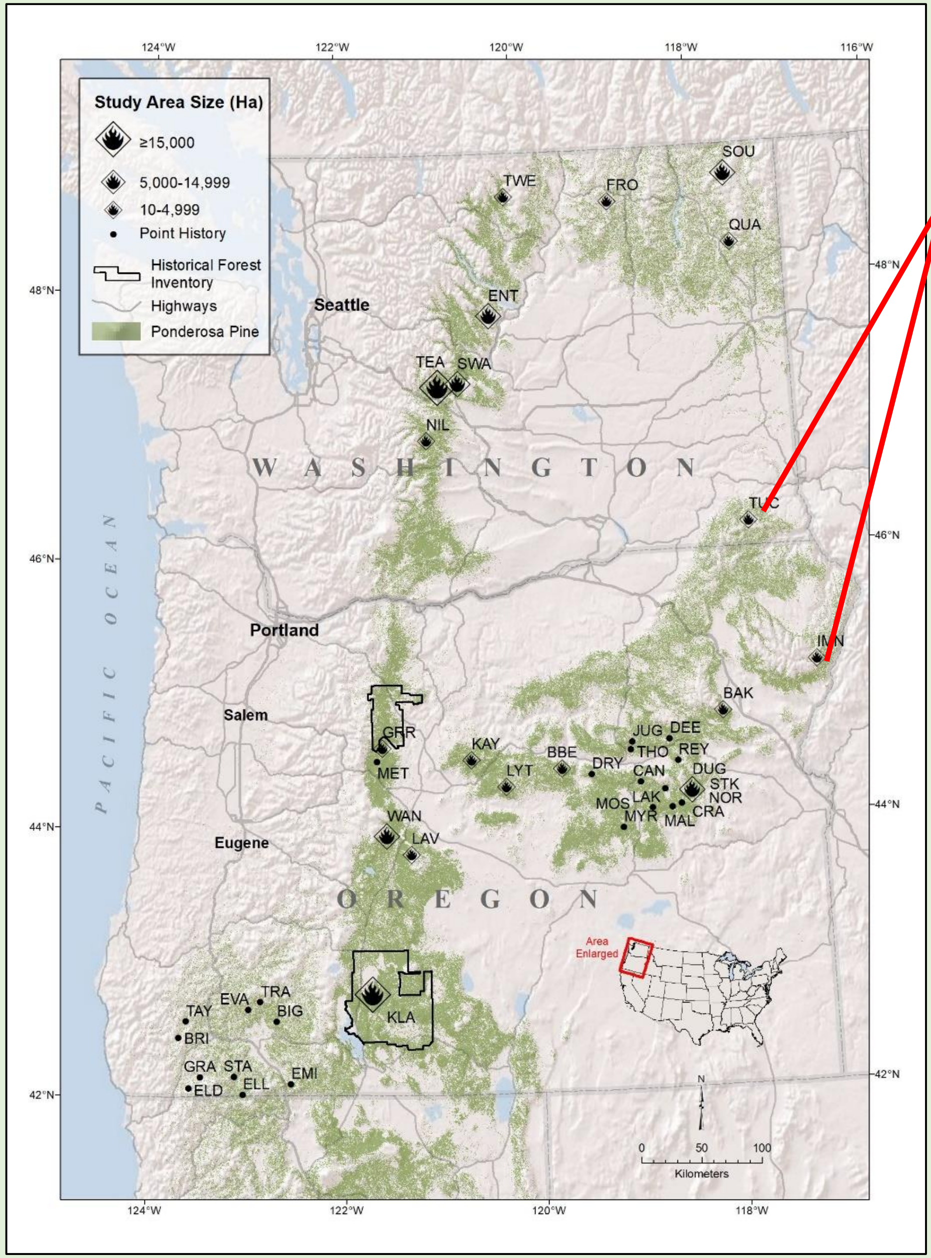
Forever 21?

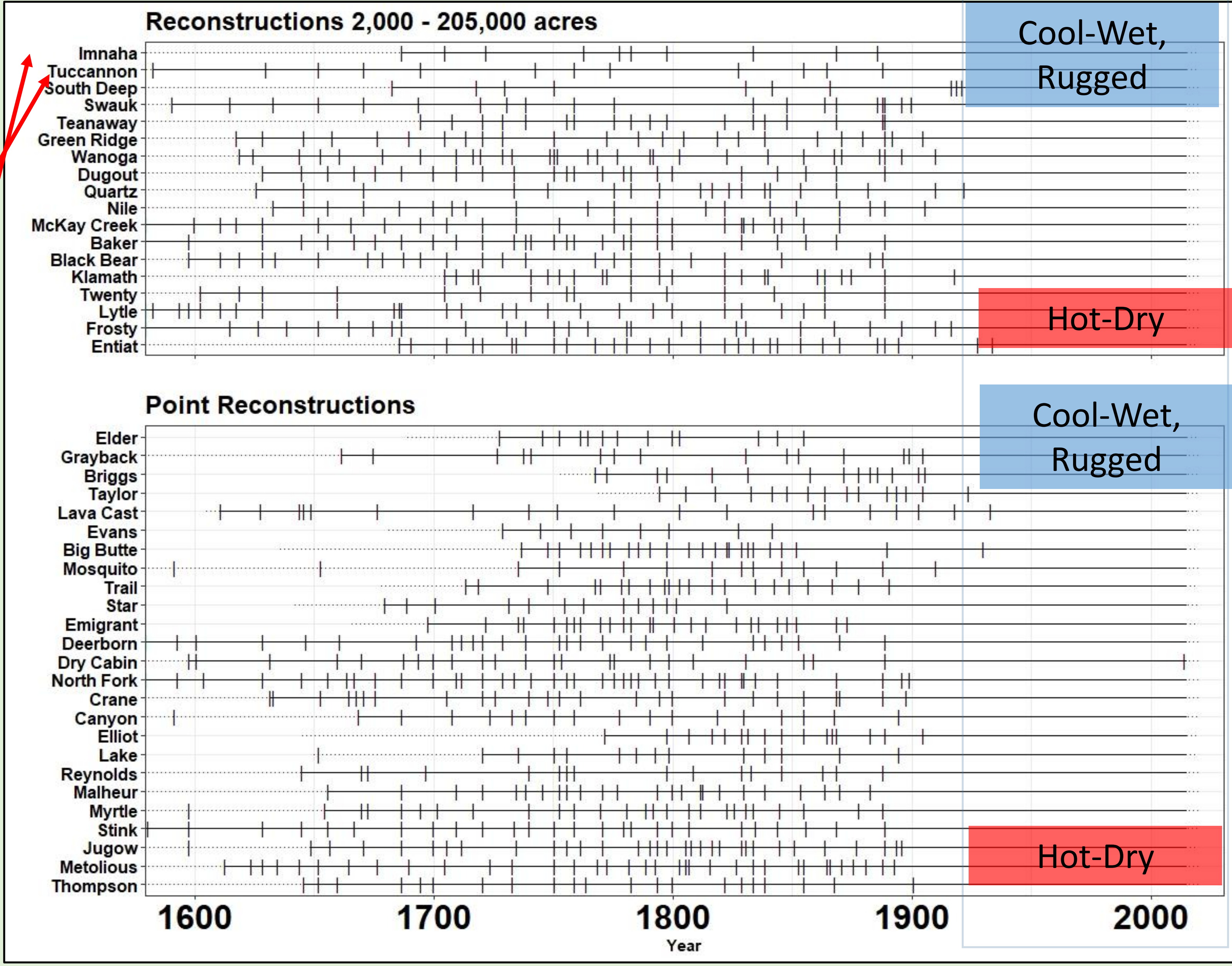


55% of large grand fir are young

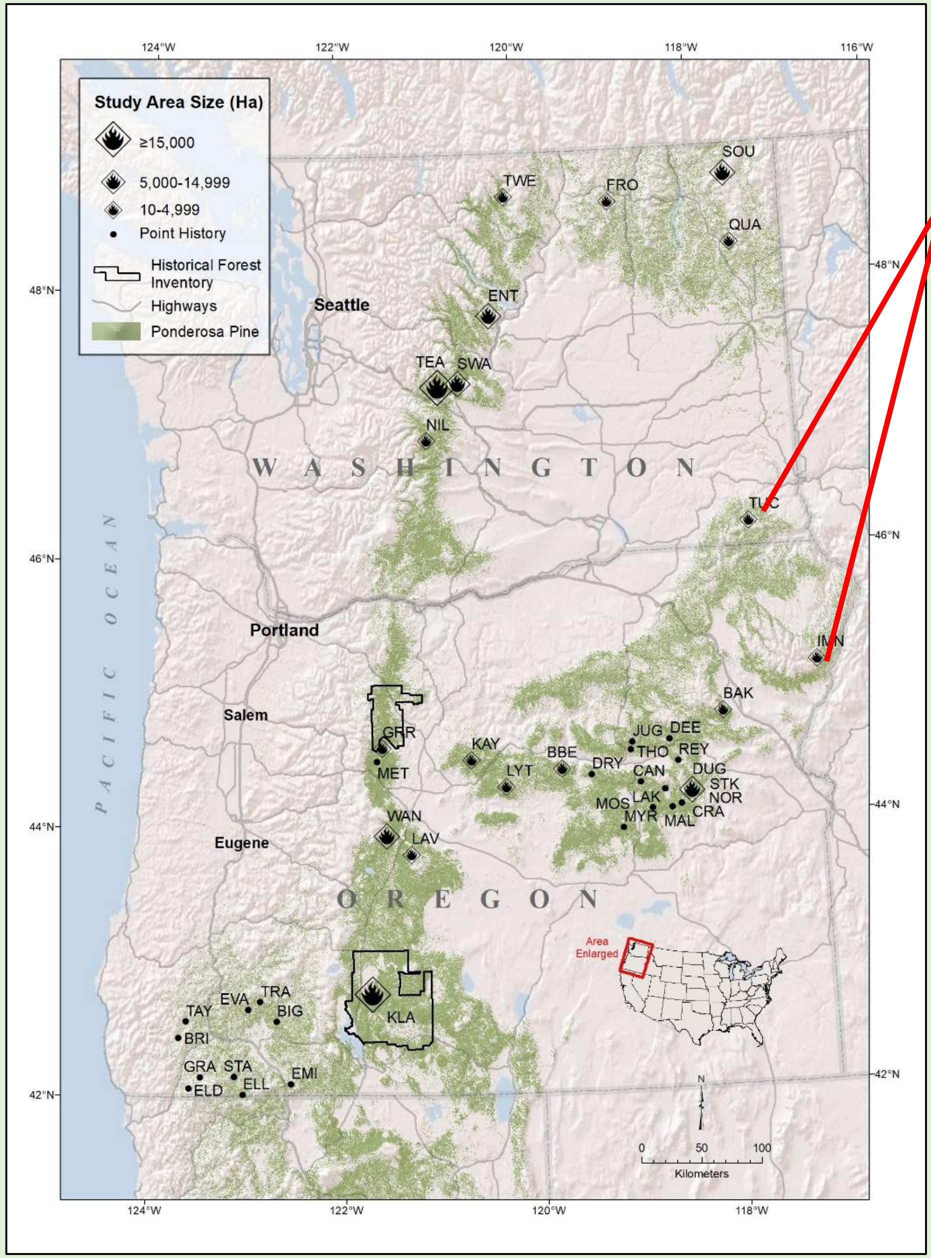
38% of small ponderosa pine are old

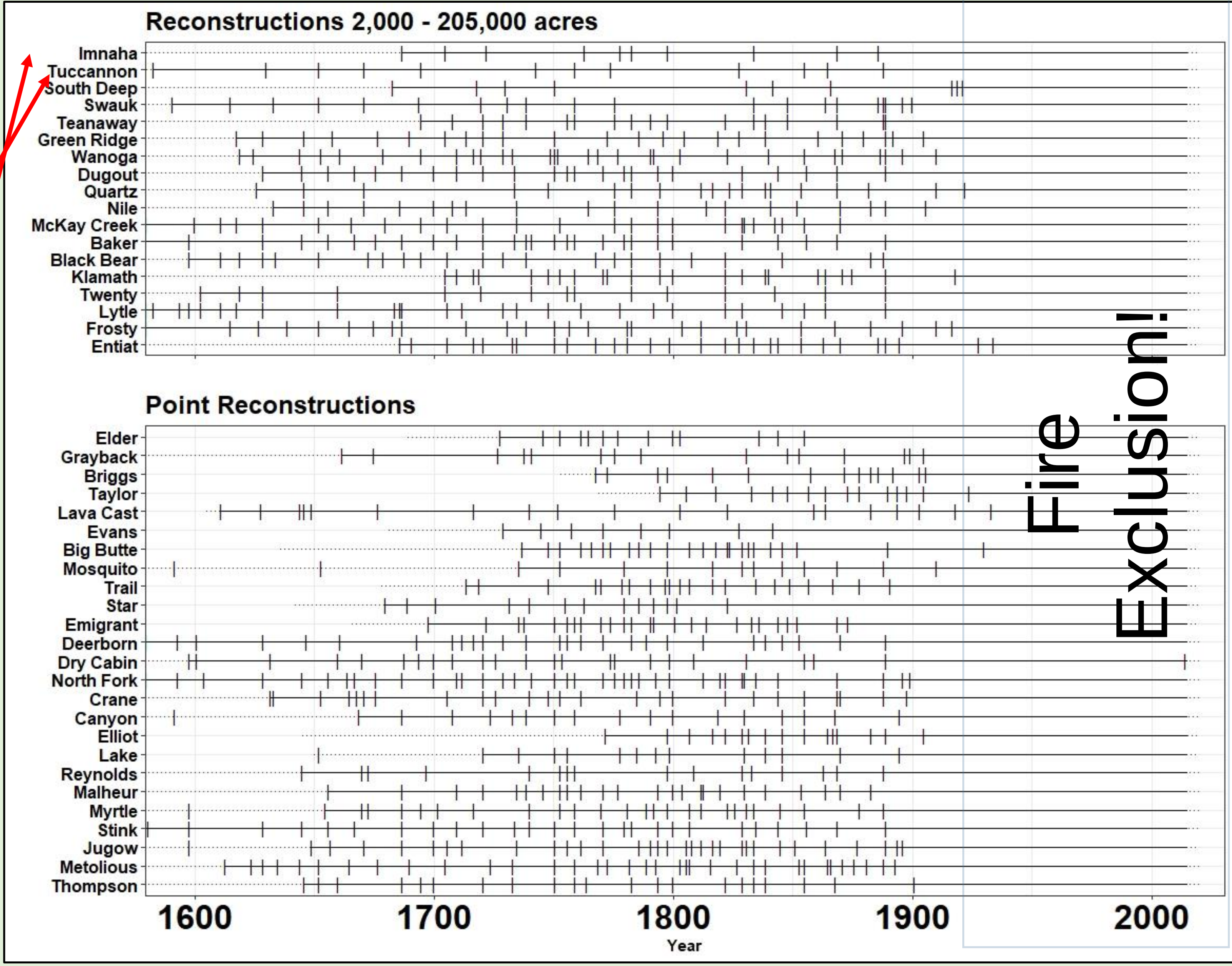
Dry Forests With Frequent Fire



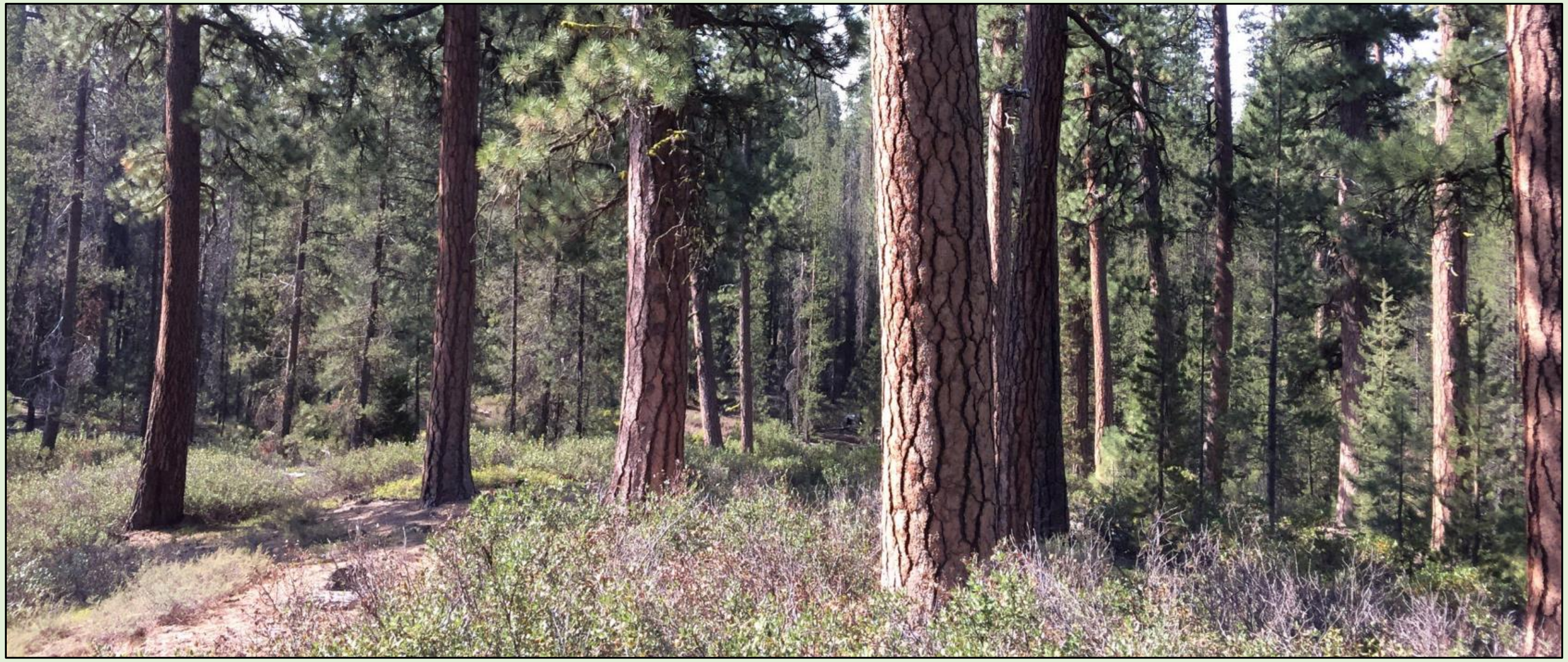


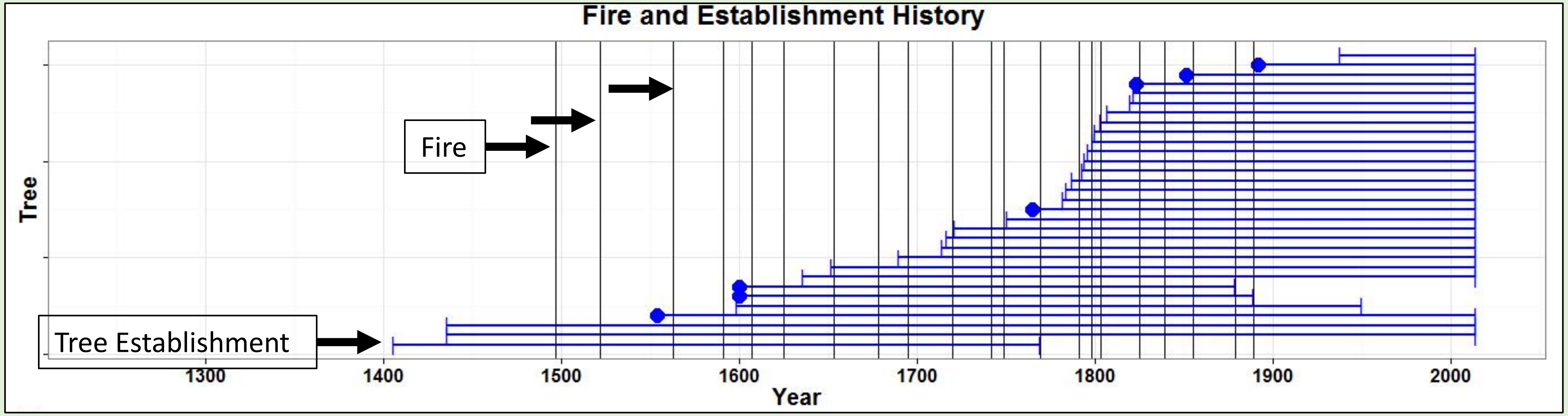
Dry Forests With Frequent Fire



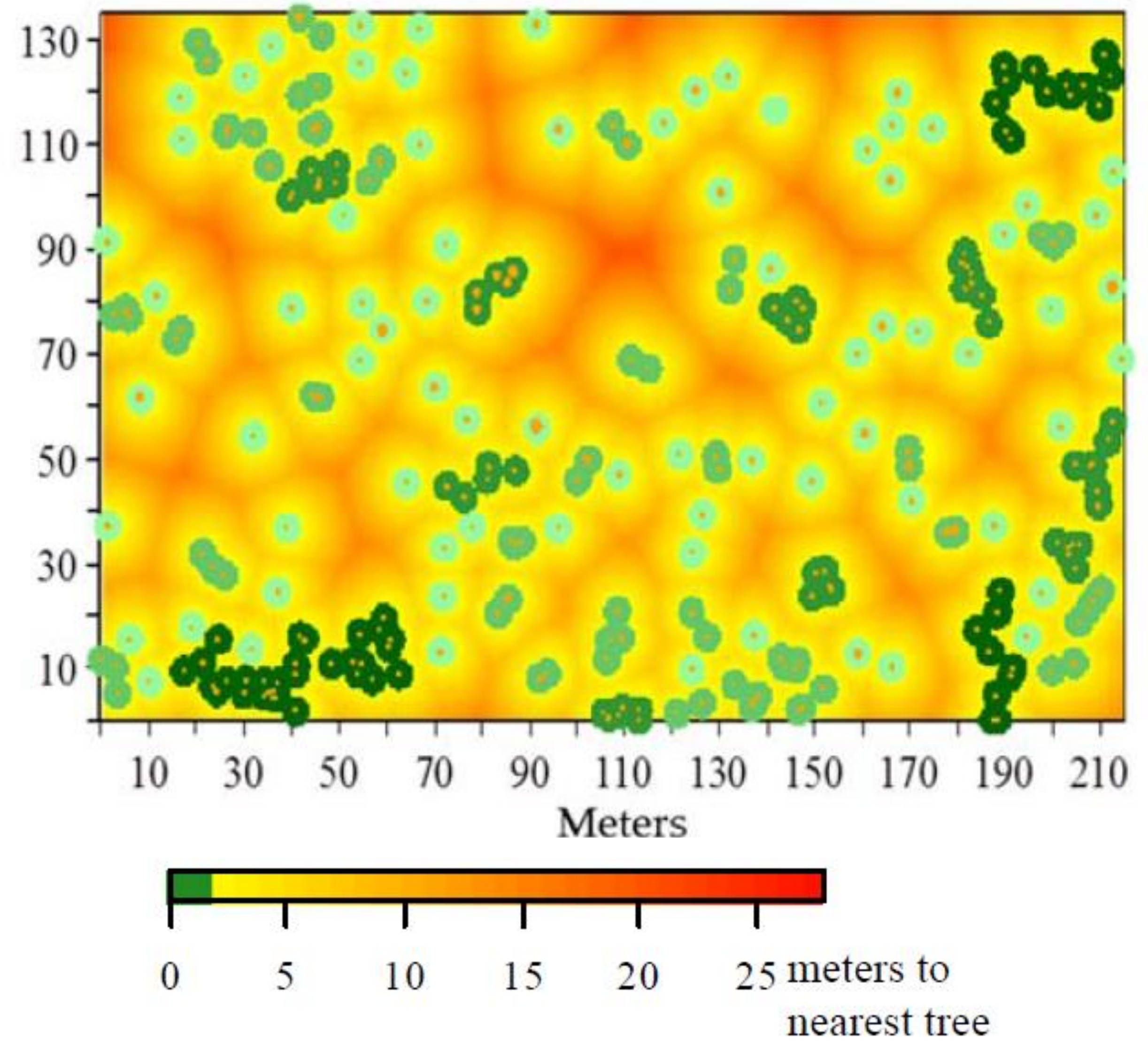


Fine Scale Heterogeneity – Tree Ages



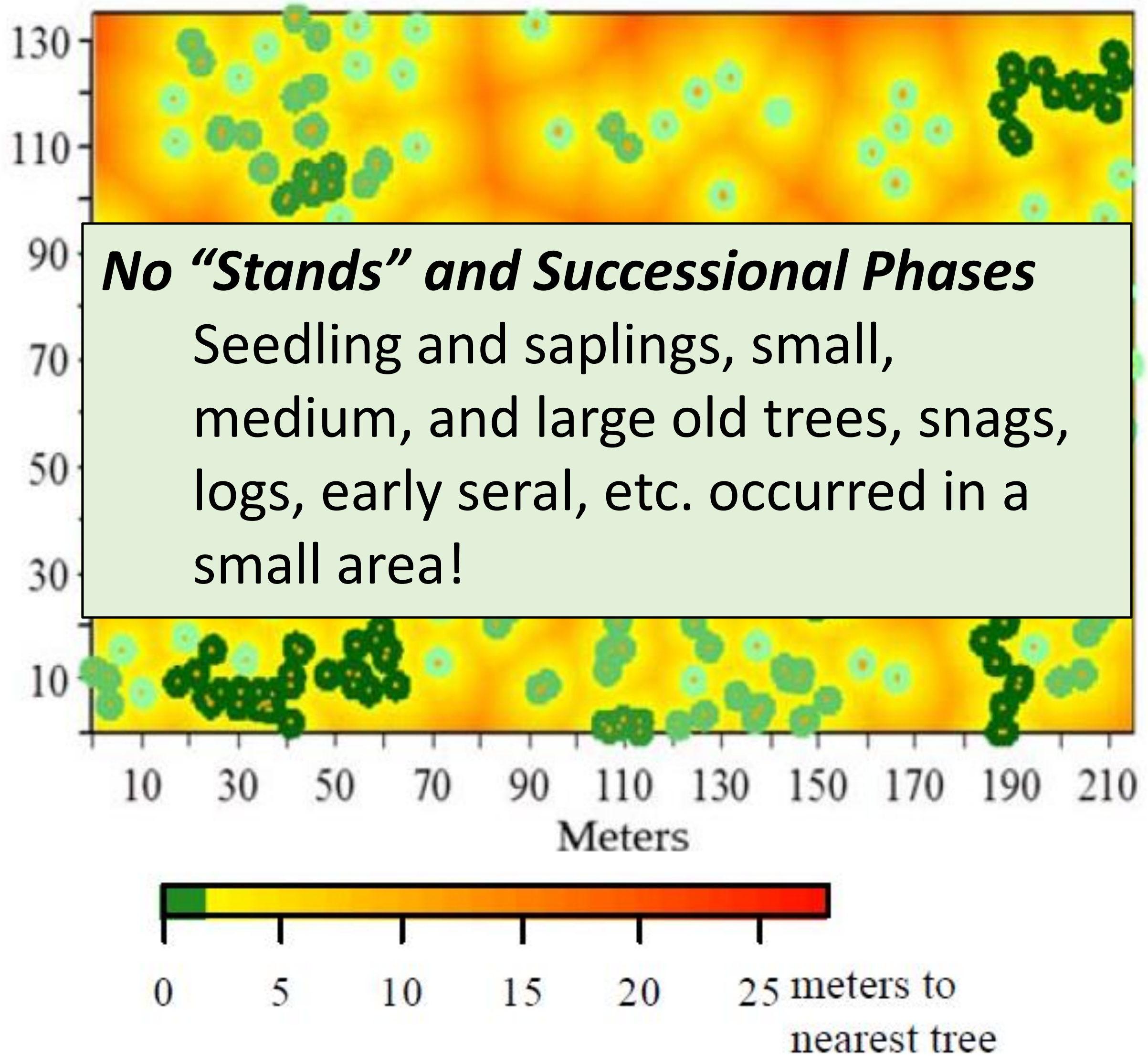


Fine Scale Heterogeneity – Forest Structure



Churchill et al. 2014

Fine Scale Heterogeneity – Forest Structure

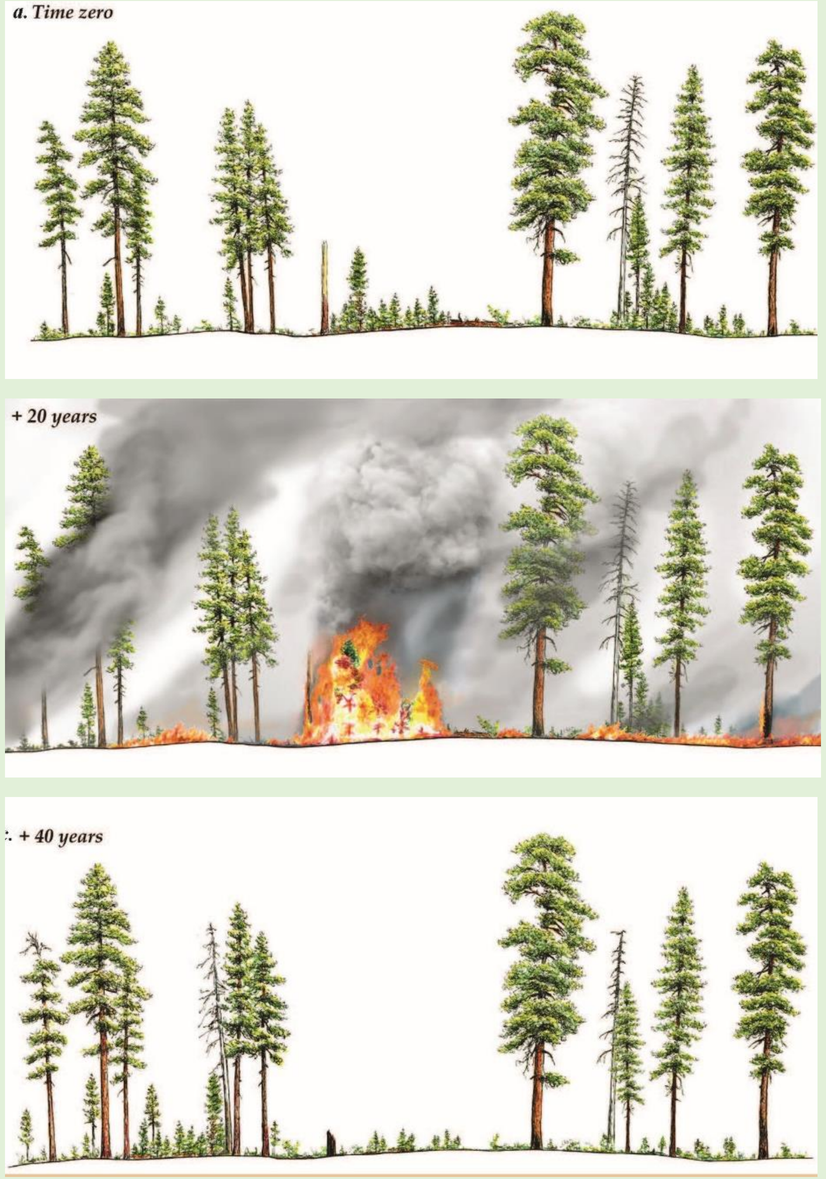


No "Stands" and Successional Phases

Seedling and saplings, small, medium, and large old trees, snags, logs, early seral, etc. occurred in a small area!

Churchill et al. 2014

Resistance in Dry Forests with Frequent Fire



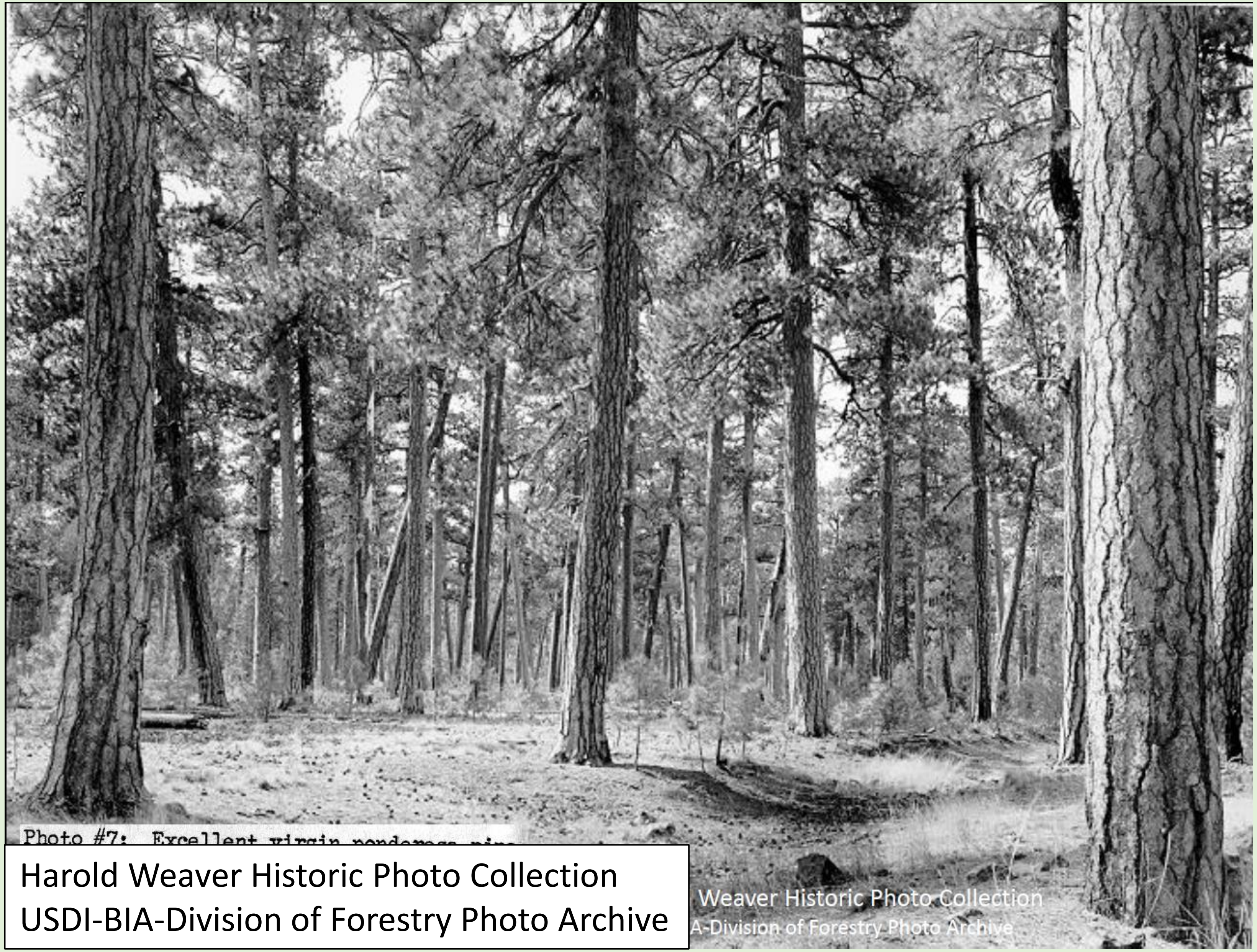
Van Pelt 2008

Disturbance Creates Resistant Structure

Chronic low-severity fire truncates succession and drives fine-scale dynamics

Resistant Forest Structure

- Low-density, open canopied forests with the majority of basal area in large, fire- and drought-resistant trees
- Low surface fuels
- Many tree ages and sizes
- Individuals, Clumps, and Openings
- Low contagion of tree canopies and roots
- Low inter-tree competition

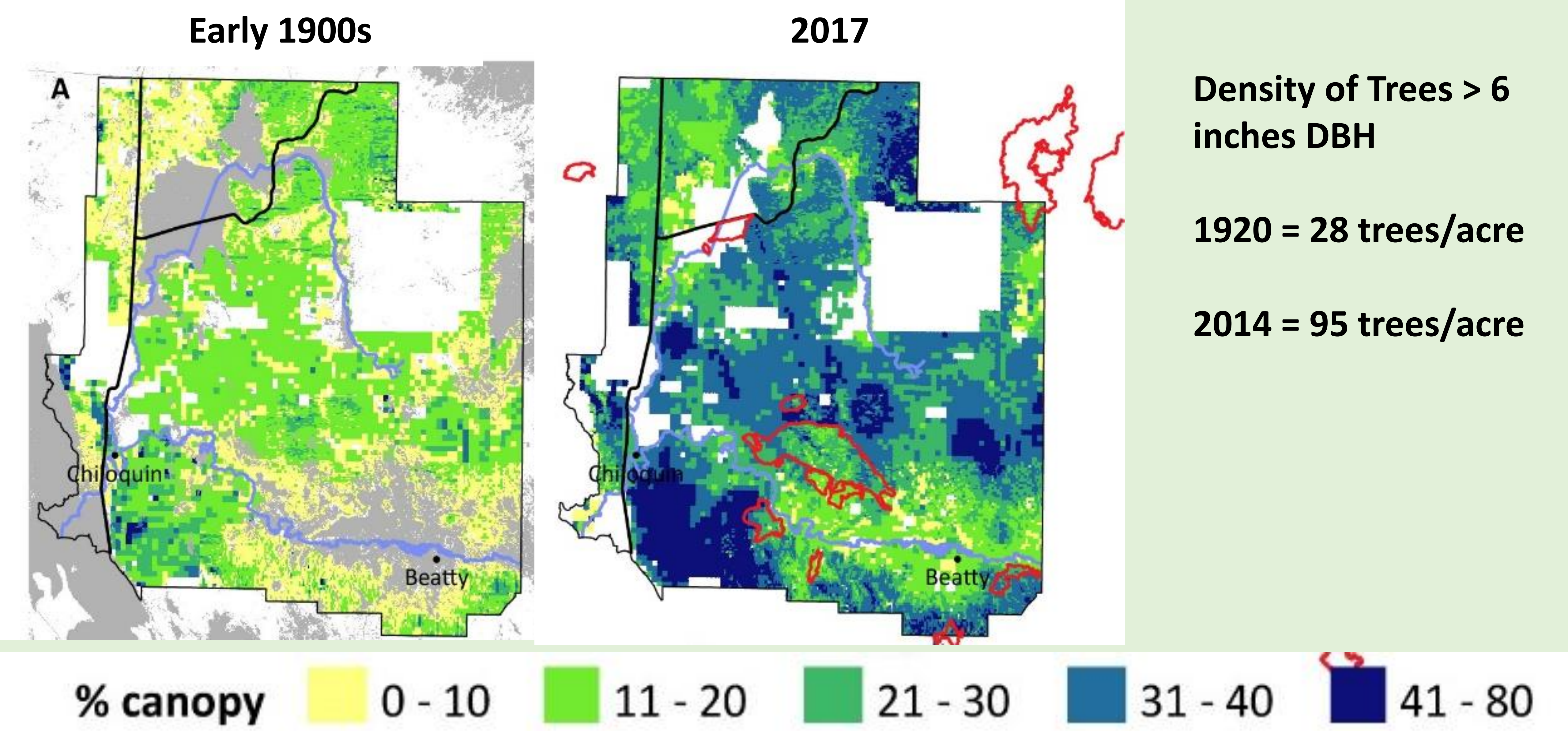


Harold Weaver Historic Photo Collection
USDI-BIA-Division of Forestry Photo Archive

Resistance was manifest at fine-scales, but maintained ecosystem structure and function extensively across dry forest landscapes from xeric pine to moist mixed-conifer environments

Loss of Resistance in the 21st Century

Hagmann et al. 2019



Density of Trees > 6 inches DBH

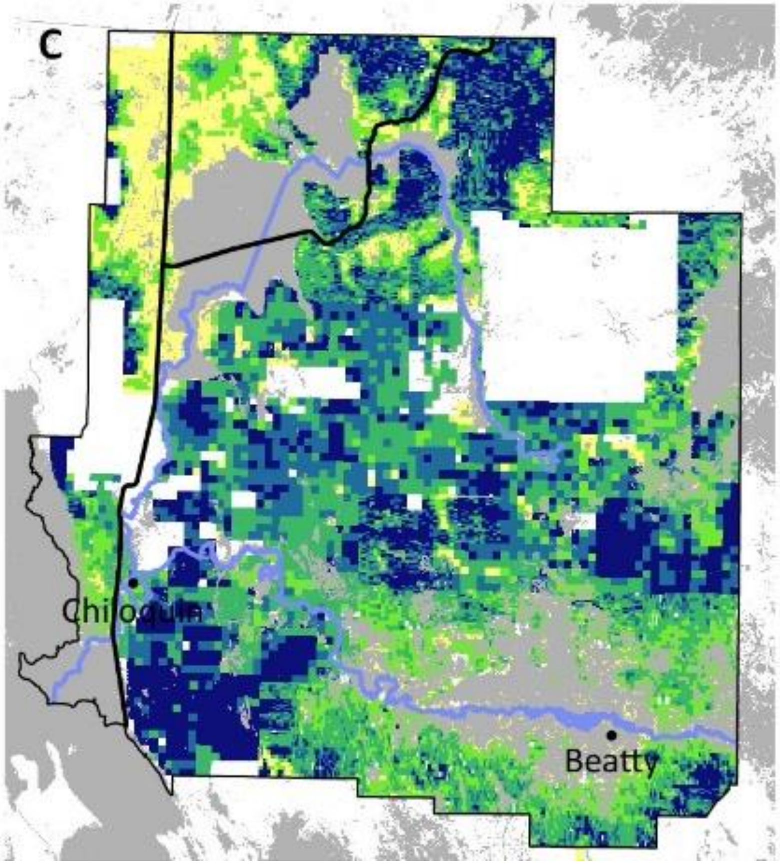
1920 = 28 trees/acre

2014 = 95 trees/acre

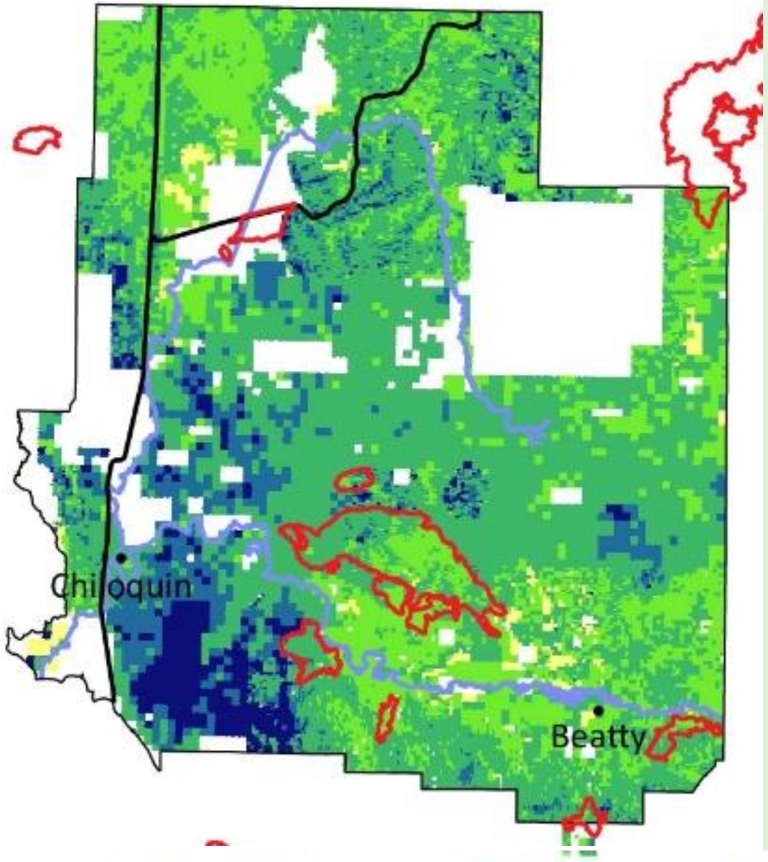
Loss of Resistance in the 21st Century

Hagmann et al. 2019

Early 1900s



2017



Trees per Acre > 21"

0 | 1-4 | 5-10 | 11-14 | >15

Early 1900s

Large trees made up 86% of basal area

Density of large and small trees was nearly equal! (44% to 56%)

Contemporary

Large trees make up 30% of basal area

9 in 10 trees are small

Take Home Message

Policies that create or perpetuate uniform conditions or “stands” and develop late seral climax composition and structure are largely inconsistent with resistant historical conditions and dynamics in dry forests

Panel 3 – Questions & Answers

James Johnston
Oregon State University

Andrés Holtz
Portland State University

Andrew Merschel
Oregon State University

Welcome Shane Jeffries

Shane Jeffries
Forest Supervisor,
Ochoco National Forest

Thank you

Please join us at the upcoming technical workshops.

- **Intergovernmental Technical Workshop**: Weds. May 13, 1–4 p.m. PDT

  Who Should Attend: Designed for county, state, and tribal government representatives. Co-hosted by the Eastern Oregon County Association.

- **Partner Technical Workshop:** Fri., May 15, 1–4 p.m. PDT

  Who Should Attend: Participants representing a broad range of interests and/or who are highly engaged with national forest management.

Connection information can be found at our project website: **Eastside Screens Plan Amendment** at **https://go.usa.gov/xvV4X**

Forest Service